DON RIVER DRY WEATHER OUTFALL SURVEY

TECHNICAL REPORT #11

A REPORT
OF THE

TORONTO AREA WATERSHED
MANAGEMENT STRATEGY
STEERING COMMITTEE

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By:

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Toronto, Ontario

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EXECUTIVE SUMMARY

Project Objectives

During the late summer and fall of 1984, a dry weather outfall survey was conducted on all outfalls discharging to the Don River and its tributaries. The survey was conducted as part of the ongoing Toronto Area Watershed Management Strategy Study (TAWMS) and was carried out with regard to the following specific objectives:

(1) To inventory and document all existing outfalls on the Don River and its tributaries.

(2) To assess the loadings and concentrations of selected contaminants discharged in dry weather from all existing outfalls to the Don River and its tributaries.

(3) To identify and prioritize, on the basis of observation, outfalls discharging contaminants in concentrations in excess of modified municipal sewer-use bylaw limits.

Methodology

The field program was conducted in three phases: pre-survey, consecutive screening and intensive sampling.

Pre-Survey

During this phase, historical outfall information was collected from the Ministry of the Environment and the municipalities. This information was used to assist in reach designation, and in the identification of potential problem outfalls. Information collected included municipal outfall maps, historical bacteriological data from selected outfalls and stream station water quality data (where available).

As well, field crews were equipped and trained in survey methodology.

Consecutive Screening Surveys

The second study phase consisted of two consecutive screening runs. All outfalls were inventoried and documented. Where possible, samples were taken, flow was determined and other field measurements were made. Analytical results from the screening runs were reviewed and those outfalls with significant levels of contamination on at least one occasion were selected for subsequent intensive sampling.

Intensive Sampling

The final phase of the field program consisted of intensively sampling selected outfalls up to 4 additional times.

Outfall Classification

Outfalls were then classified on a parameter by parameter basis to assist the municipalities and the Ministry in prioritizing problem outfalls. The Metropolitan Toronto sewer-use bylaw modified to include fecal coliform and TKN criteria was used to assist in outfall categorization. Outfalls exceeding modified bylaw limits and having a minimum of 4 results for a given parameter, were classified as being in Group A. This group was considered to have sufficient information to define the extent of any contamination problem.

Outfalls sampled less than four times but which exceeded modified bylaw limits for one or more parameters were classified as Group B. For the most part, this group was felt to be of less priority than the Group A outfalls and should be considered to have insufficient data to assess the extent of contamination (i.e. additional outfall sampling is needed). Both Group A and B outfalls were ranked by the number of bylaw violations, and by the average outfall discharge load for all parameters except fecal coliforms. Ranking for fecal coliform violations were based soley upon loading.

Results and Discussion

In total, 1423 outfalls were located and inventoried on the river and its tributaries. Outfalls inventoried included 1185 storm sewers (83%), 30 combined sewers (2%), 112 tributaries (8%) and 96 drainage ditches (7%). One industrial outfall was also identified. A total of 689 outfalls or 48%

of all outfalls surveyed were actively flowing. There were 39 outfalls which were submerged into river water and were not sampled at upstream manholes due to manpower limitations. In addition, there were 20 outfalls in the lower reaches adjacent to the Don Valley Parkway and the Keating Channel that were not sampled due to access difficulties.

Forty-two percent of the surveyed outfalls were sampled during the screening runs. Of the sampled outfalls, 59% were sampled at least twice.

A total of 170 or 29% of the sampled outfalls were intensively surveyed. Of this total, 154 were storm sewer outfalls, 8 were CSOs, 7 were tributaries and 1 was a drainage ditch. The number of CSOs sampled intensively represented 27% of the total discharging to the river in dry weather.

The total measured discharge into the Don River was 1.65 m^3/s. Treated effluent from the North Toronto Water Pollution Control Plant (WPCP) accounted for 24% of this total.

Reported average concentrations of parameters at the North Toronto WPCP (average over study period obtained from WPCP data) were higher than those measured from outfalls for all parameters but fecal coliforms (34 org/100 mL) and chromium (<.01 mg/L).

Fecal coliform criteria were exceeded in approximately 16% of all sampled outfalls. Other frequently observed modified bylaw violations at sampled outfalls were suspended solids (31%) and iron (25%). Few heavy metal problems were observed .

The following summarizes major findings with respect to outfall loadings:

- North Toronto WPCP was a major source of loadings of several parameters, including BOD (31%), lead (19%), copper (7%), chromium (15%) and iron (4%).

- Outfalls in the lower reaches of the Don River accounted for high proportions of the total input of several pollutants.
  - TB 20:fecal coliform (5%), BOD (6%)
  - TB 27:fecal coliform (3%), BOD (5%), TKN (4%), phenolic (4%)
  - TB 40:fecal coliform (1%), lead (3%), chromium (23%)
  - TB 47:fecal coliform (8%), BOD (1%)
  - TB 36:fecal coliform (1%)

- Some outfalls discharging into Massey Creek were found to contribute a high fraction of the total pollutant loads, for example:
  - SC 421:BOD (2%)
  - SB 368:zinc (8%)
  - SC 472:BOD (2%)
  - SC 1800:BOD (1%)
- Suspended solids loads were high in areas associated with construction, for example: RG 944 (36% of total input) and on Burke's Brooke (TH 131, 14% of total). Outfall RG 944 was also responsible for the following amounts of the total loads: 10% of the TKN, 11% of the zinc and 53% of iron.
- Outfall NR 1164 accounted for 79% of the total phosphorus input into the river.
- Outfall EH 162 accounted for 38% of the total phenols load into the river.
- On one occasion, outfall NR 1254 had a high copper concentration which amounted to 63% of the observed total copper load.

A total of 156 Group A Outfalls were identified. In addition, 284 outfalls were categorized in Group B.

Recommendations

(1) Outfalls in Group A which are consistent contributors of pollutants and are therefore of high priority, should be investigated to locate the source of the contaminants.

(2) Outfalls in Group B which are listed as high priority should have additional sampling conducted at the outfall to assess the extent of the problem.

(3) Remaining submerged outfalls should be investigated at the first upstream manhole to assess the effluent quality of those outfalls.

RÉSUMÉ

Le présent rapport contient les résultats d'une étude menée sur l'ensemble des exutoires se déversant par temps sec dans la rivière Don et ses affluents. L'étude consistait en deux opérations de sélection visant à repérer les exutoires présentant un niveau sensible de pollution, suivies par des prélèvements répétés d'échantillons dans ces exutoires. Au total, on a repéré et inventorié 1423 exutoires, dont 598 ont fait l'objet de prélèvements d'échantillons au cours des opérations de sélection et 170 ont été soumis à un échantillonnage intensif. Environ 16 pour 100 de tous les exutoires analysés montraient un taux de coliformes fécaux supérieur au critère établi. Nous avons noté peu de cas de problèmes relatifs à la présence de métaux lourds. Cent cinquante-six exutoires jugés hautement prioritaires devraient faire l'objet d'études visant à trouver la source de pollution; 284 autres exigent des échantillonnages supplémentaires afin d'évaluer l'étendue du problème.

1.0 INTRODUCTION

1.1 Background

The Don River watershed encompasses an area of 360 km^2 in one of the most densely populated regions of Southern Ontario. The strategic location of the river has resulted in increasing urbanization since the 18th century. Much of the watershed is at present under urban land-use, with extensive industrial areas often located in proximity to the river.

The overall effect of urban development has been a deterioration of water quality.

Concern for the poor water quality in the Don River, and its effects on the Lake Ontario waterfront area, prompted the Ontario Ministry of the Environment, through the Toronto Area Watershed Management Strategy Study (TAWMS), to commission an inventory and dry weather survey (quantity and quality) of outfalls discharging to the Don River and its tributaries. The following report presents the results of this survey which was conducted during the summer and fall of 1984.

1.2 Project Objectives

The Don River Dry Weather Outfall Survey was designed to meet the following major objectives:

(1) To inventory and document all existing outfalls on the Don River and its tributaries.

(2) To assess the loadings and concentrations of selected contaminants discharged in dry weather from all existing outfalls to the Don River and its tributaries.

(3) To identify and prioritize, on the basis of observation, outfalls discharging contaminants in concentrations in excess of modified municipal sewer-use bylaw limits.

2.0 DESCRIPTION OF STUDY AREA

2.1 Population and Land Use Activities

Seven municipalities located within Metropolitan Toronto and the Regional Municipality of York fell within the study area. Figure 1 presents the area of the watershed relevant to the present study and indicates the location of the municipalities adjacent to the river and its tributaries.

The populations and approximate percentage of each municipality located within the Don River watershed are summarized in Table 1. Based on this data, it is estimated that 775,792 people reside within the watershed at an average population density of 21.5 persons per hectare.

TABLE 1. POPULATION AND PERCENT OF AREA OF MUNICIPALITIES WITHIN THE DON RIVER WATERSHED AREA

MUNICIPALITY	CLASSIFICATION	POPULATION *	ESTIMATED % OF AREA WITHIN WATERSHED
East York	Borough	94,476	95
Markham	Town	12,290	15
North York	City	420,332	75
Richmond Hill	Town	9,622	25
Scarborough	City	43,598	10
Toronto	City	184,429	30
Vaughan	Town	11,045	30

* Values as of 1982 (Min. of Municipal Affairs, 1984).

Present land use activities in the Don River watershed are shown in Figure 2. The watershed is virtually all urbanized with the exception of certain areas north of Steeles Ave. As was noted, industrial development occurs throughout the watershed, with significant concentrations of industry located in the Don Valley core area between Highway 401 and St. Clair Ave., along Massey Creek, and near the mouth of the river along the Keating Channel.

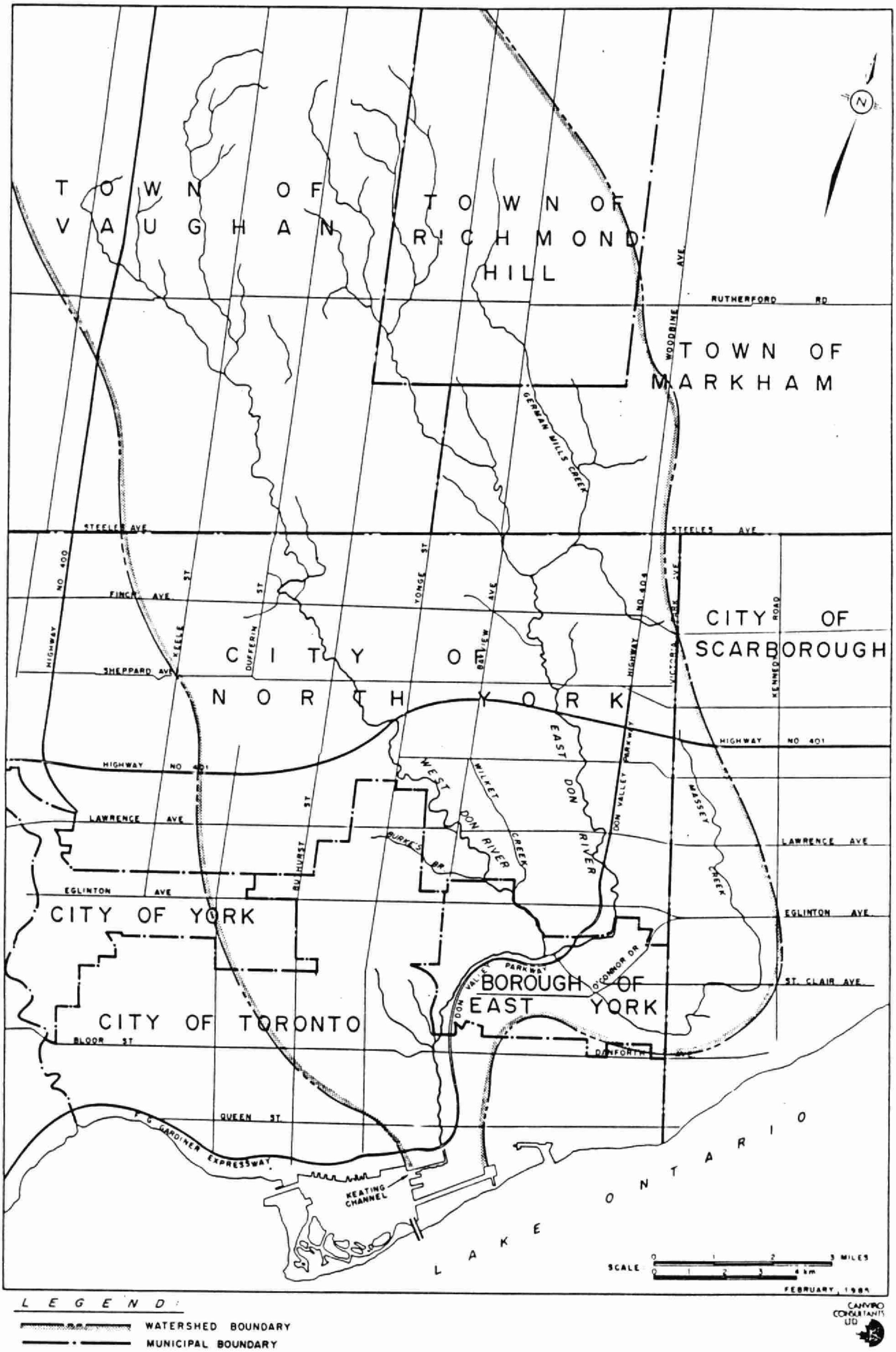
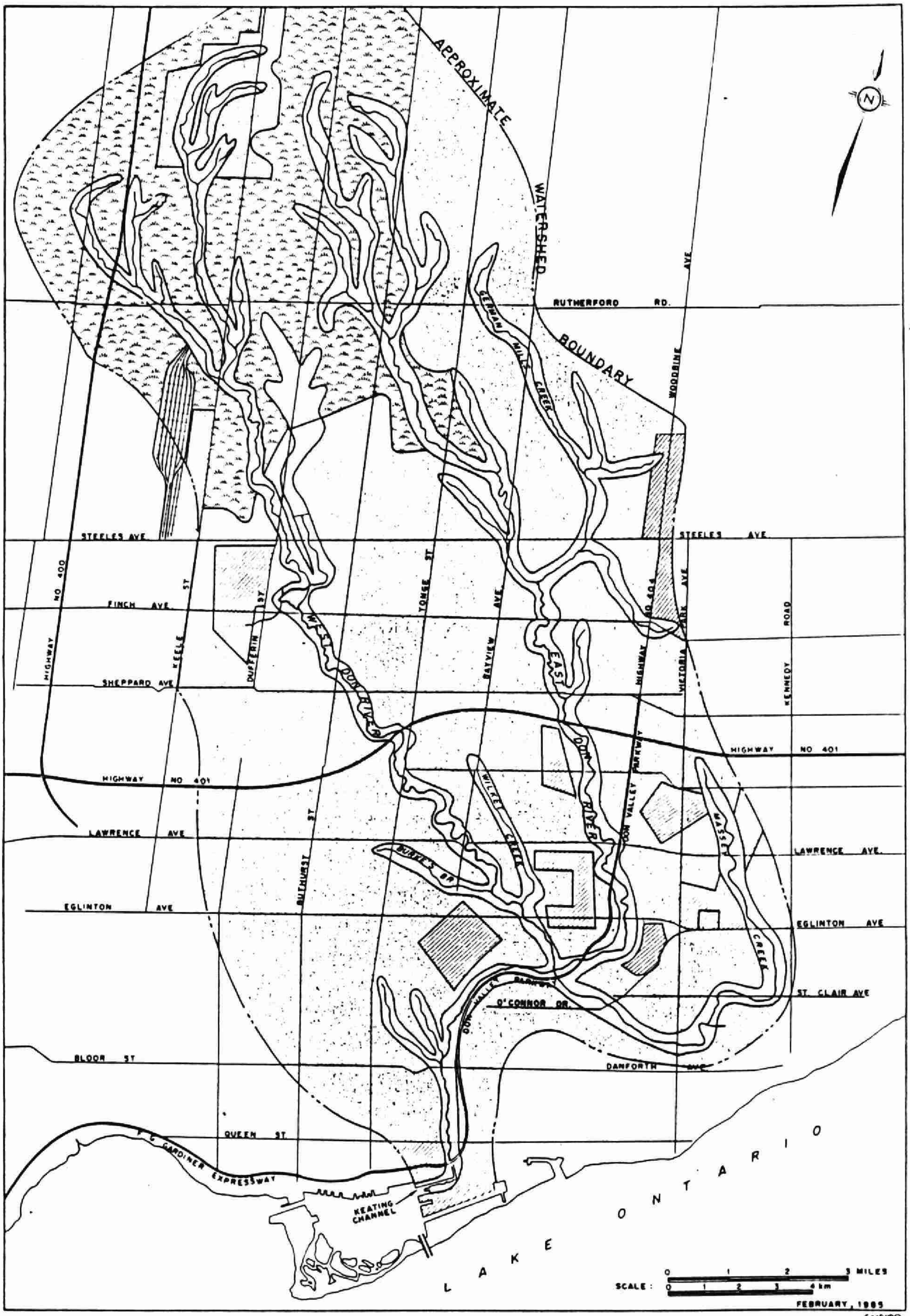


FIGURE 1 — DON RIVER WATERSHED AND MUNICIPALITIES WITHIN STUDY AREA



L E G E N D :

INDUSTRIAL
AGRICULTURAL
RESIDENTIAL - COMMERCIAL
FLOOD PLAIN (APPROXIMATE)
RAILYARD

FIGURE 2 – LAND USE ACTIVITIES WITHIN THE DON RIVER WATERSHED

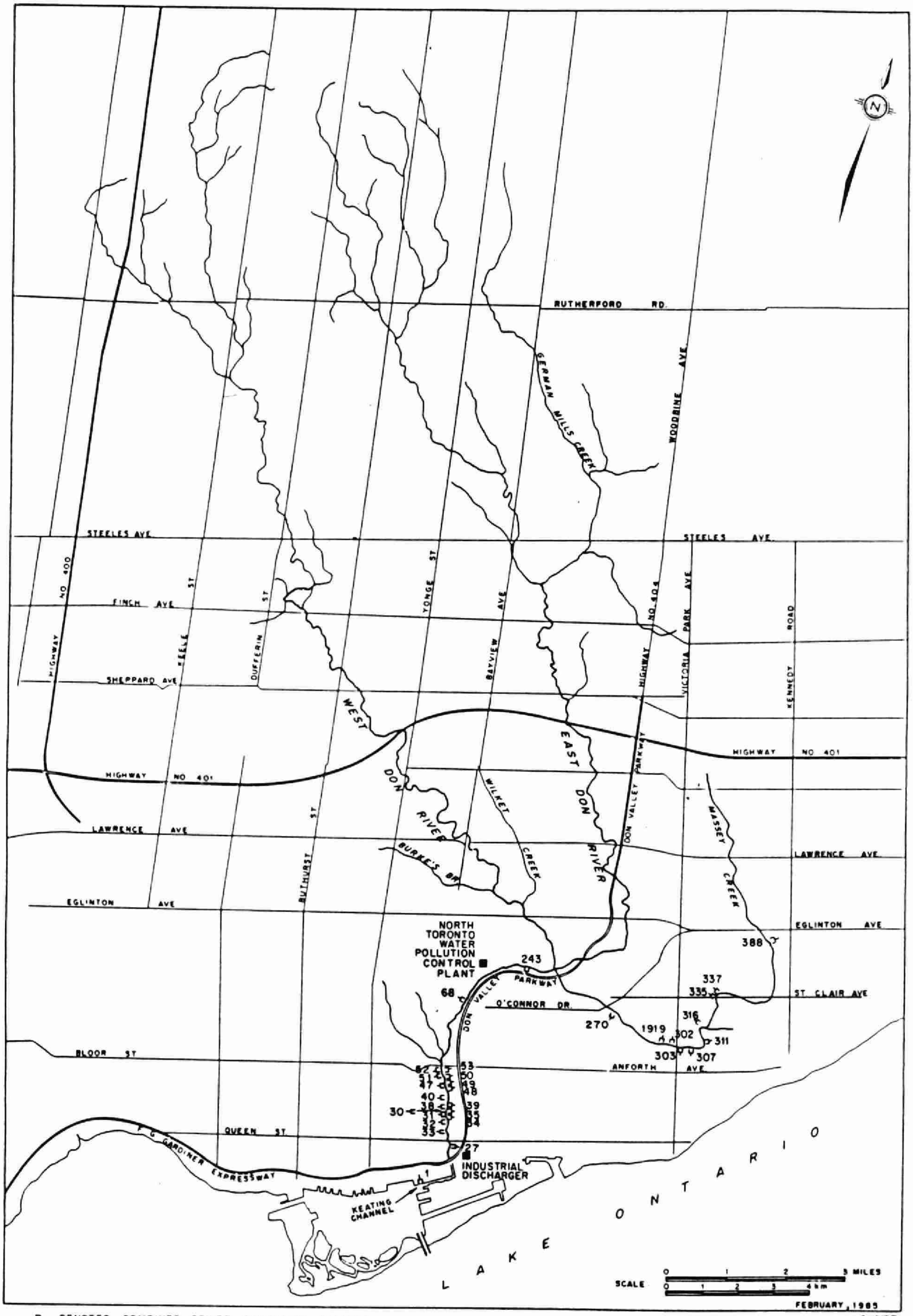
2.2 Dry Weather Pollutant Inputs

Potential and known sources of dry weather pollutant inputs discharging into the Don River include:

- Stormwater outfalls discharging effluent which may be contaminated by domestic, commercial or industrial inputs through cross connections.
- Combined sewer outfalls which in dry weather discharge infiltration flows possibly contaminated by residual waste material from combined sewer overflows and/or dry weather combined sewer overflows.
- Drainage ditches or tributaries which may be contaminated by urban, industrial or agricultural discharges.
- North Toronto WPCP effluent.
- Industrial effluent (single industry).
- Leachates from active and/or abandoned landfill sites.

Figure 3 presents the locations of the 30 combined sewer outfalls discharging to the Don River. Combined sewer outfalls are located exclusively in the lower reaches of the river and on Massey Creek. Outfall locations were obtained from a review of existing maps.

A single industrial establishment discharges cooling water to the river near the upstream inlet of the Keating Channel on the east side of the Don Valley Parkway. In addition, the North Toronto Water Pollution Control Plant (WPCP) discharges treated secondary effluent further upstream, at a location just below Eglinton Ave.



⊃ DENOTES COMBINED SEWER OVERFLOW OUTFALL

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FIGURE 3 – LOCATION OF COMBINED SEWER OVERFLOWS ON DON RIVER

3.0 MUNICIPAL AND MODIFIED SEWER-USE BYLAWS

In order to assess if the dry weather discharge from a particular outfall was contaminated, a yardstick or criterion was required.

The WPCP effluent is governed by criteria based upon the Provincial Water Quality Objectives. The quality of dry weather discharges into storm and combined sewers fall under municipal jurisdiction and are governed by sewer-use bylaws. These sewer-use bylaws are promulgated by the municipality within whose boundaries the sewers exist. The bylaws specify maximum permissible contaminant concentrations for selected parameters. Any exceedence of criteria is technically considered a bylaw violation. Within the Metropolitan Toronto and the Regional Municipality of York areas (upper tier), both the member municipalities (lower tier) and the upper tier municipalities have enacted sewer-use bylaws. Table 2 presents a summary of bylaw limits for all the municipalities.

For the sake of uniformity, the Metropolitan Toronto and Regional Municipality of York bylaws, modified to include TKN and fecal coliform criteria, were applied across the board to the appropriate reaches of the Don River and its tributaries. Copies of the Metro Toronto and York Region sewer-use bylaws are provided in Appendix X.

A TKN criterion was specially developed for this study using the Metro ammonia bylaw limit of 10 mg/L and the assumption that ammonia constitutes 50% of the TKN concentration (i.e. TKN = 10 x 2 = 20 mg/L).

A fecal coliform guideline was developed by the TAWMS Abatement Committee. The guideline consisted of the following multiple conditions:

i) average loading calculated from four or more samples in excess of 10,000 org/s, and

ii) average flow on the four or more sampling occasions in excess of 0.1 L/S.

TABLE 2. SUMMARY OF MUNICIPAL STORM SEWER-USE BYLAWS

PARAMETER	SYMBOL	UNITS	MUNICIPALITY OR REGION										
			YORK REGION	VAUGHAN	RICHMOND HILL	MARKHAM	BOROUGH OF EAST YORK	METROPOLITAN TORONTO	SCARBOROUGH	NORTH YORK	TORONTO	MODIFIED METRO	MODIFIED YORK
Aluminum	Al	mg/L	1	1	NA	1	NA	1	1	NA	1	1	1
Ammonia (1)	NH_3	mg/L	10	10	NA	10	NA	10	NA	NA	10	10	10
Arsenic	As	mg/L	1	1	NA	1	NA	1	1	NA	1	1	1
Barium	Ba	mg/L	0.1	0.1	NA	0.1	NA	1	1	NA	1	1	0.1
Cadmium	Cd	mg/L	0.1	0.1	1	0.1	1	0.1	0.1	1	0.1	0.1	0.1
Chlorine	Cl_2	mg/L	1	1	NA	1	1	1	1	NA	1	1	1
Chlorides	Cl	mg/L	NA	NA	1500	1500	1500	NA	NA	1500	NA	NA	NA
Chromium	Cr	mg/L	1	1	NA	1	NA	1	1	1	1	1	1
Copper	Cu	mg/L	1	1	1	1	5	1	1	5	1	1	1
Cyanide	HCN	mg/L	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fluoride	F	mg/L	2	2	NA	2	NA	2	2	NA	2	2	2
Iron	Fe	mg/L	1	1	17	1	17	1	1	17	1	1	1
Lead	Pb	mg/L	1	1	0.1	1	5	1	1	NA	1	1	1
Manganese	Mn	mg/L	1	1	NA	1	NA	1	1	NA	1	1	1
Mercury	Hg	mg/L	0.001	0.001	NA	0.001	NA	0.001	0.001	NA	0.001	0.001	0.001
Nickel	Ni	mg/L	1	1	1	1	1	1	1	NA	1	1	1
Phenolic Compounds		ug/L	20	20	20	20	40	20	20	40	20	20	20
Phosphorus	P	mg/L	1	1	NA	1	NA	1	1	NA	1	1	1
Sulphides (2)	H_2S	mg/L	NA	NA	5	NA	NA	NA	NA	NA	NA	NA	NA
Sulphates	SO_4	mg/L	NA	NA	1500	1500	1500	NA	NA	1500	NA	NA	NA
Suspended Solids		mg/L	15	15	15	15	30	15	15	30	NA	15	15
Tin	Sn	mg/L	1	1	NA	1	NA	1	1	NA	1	1	1
Zinc	Zn	mg/L	1	1	NA	1	5	1	1	5	1	1	1
Temperature		°C	65	65	65	65	65	65	65	NA	65	65	65
BOD			15	15	15	15	20	15	15	20	NA	15	15
pH		pH	6-9.5	6-9.5	5.5-9.5	6-9.5	5.5-9.5	6-9.5	6-9.5	6-9.5	NA	6.95	6.95
Coliform Count (3)		counts/ 100 mL	NA	NA	2400	2400	2400	NA	2400	NA	NA	(4)	(4)
TKN		mg/L	-	-	-	-	-	-	-	-	-	20	20

Note: (1) As N
(2) As hydrogen sulphide
(3) Assumed to be fecal coliform
(4) Average loading calculated from four or more samples in excess of 10,000 org/s
Average flow on the four or more sampling occasions in excess of 0.1 L/s

4.0 STUDY METHODOLOGY

4.1 Field Program Design

The field program was constituted in three phases as follows:

(1) Screening Run One: All outfalls discharging to the Don River and its tributaries were inventoried. Flows from active outfalls were sampled and measured.

(2) Screening Run Two: All newly found outfalls were inventoried. Samples were taken where possible and flow and on-site measurements performed. All outfalls identified during Screening Run One were re-sampled (if possible) and a second set of on-site measurements were made.

(3) Intensive Survey: Additional data (quality and quantity) were collected on four occasions for selected outfalls which the previous screening surveys had indicated exceeded specifically formulated screening criteria for one or more parameters. These screening criteria are not necessarily the same as the modified bylaw limits used for outfall classification.

4.2 Survey Methodology

4.2.1 Pre-Survey Activities

Historical outfall information was collected, from the various municipalities and the Ministry of the Environment (MOE), to assist in reach designation and identification of potential problem outfalls. Information such as numbers and location of outfalls, location of problem outfalls and reaches of concern were obtained. In addition, municipal engineers were interviewed for the location of former and active landfill sites and to assess the accuracy of existing outfall maps.

Prior to initiation of the field program, in-depth training of the field crews in survey methodology was conducted. Crews were trained in proper sampling techniques: obtaining flow measurements, preservation and submission of samples, documentation, equipment use and safety procedures.

The river was subdivided into reaches designated by letter codes. The first letter of each reach represented the first initial of the municipality within which the reach resided (e.g. Toronto: T---). Reach designations were based on municipal boundaries, streets, and the locations of stream stations used to assess river quantity and quality in another TAWMS study. The reach designations are presented in Figure 4.

For purposes of preparing loadings estimates, reaches were grouped into sections. The sections were designed to consolidate loadings between the stream monitoring stations and major river tributaries. A summary of reaches within each section is provided in Table 3 and is depicted in Figure 5.

TABLE 3. SUMMARY OF REACHES WITHIN EACH LOADING SECTION ON THE DON RIVER

LOADING SECTION	COMPONENT REACHES
1	TA
2	TB, TC
3	EA, TD, TE, TF, TI
4	EE, ED, EK
5	EF, EG, SA
6	SC, SB, SD, SE
7	EH
8	EL
9	NJ, NK
10	NV, TH, TG
11	NM, NN, NO
12	NQ, NP, NW
13	NR, NS, NT
14	VA, VB, VD
15	VE, VF, VG, VM
16	NC, NB, NX, EI, EJ
17	NG, NU, NF, NE, ND
18	NH, NY
19	NI
20	MD, ME, VH
21	RE, RF, RD, MA, MB
22	RA, RB, RH, VJ, VK, RC, RG, VP

Notes: T-Toronto N-North York
E-East York V-Vaughan
S-Scarborough R-Richmond Hill
M-Markham

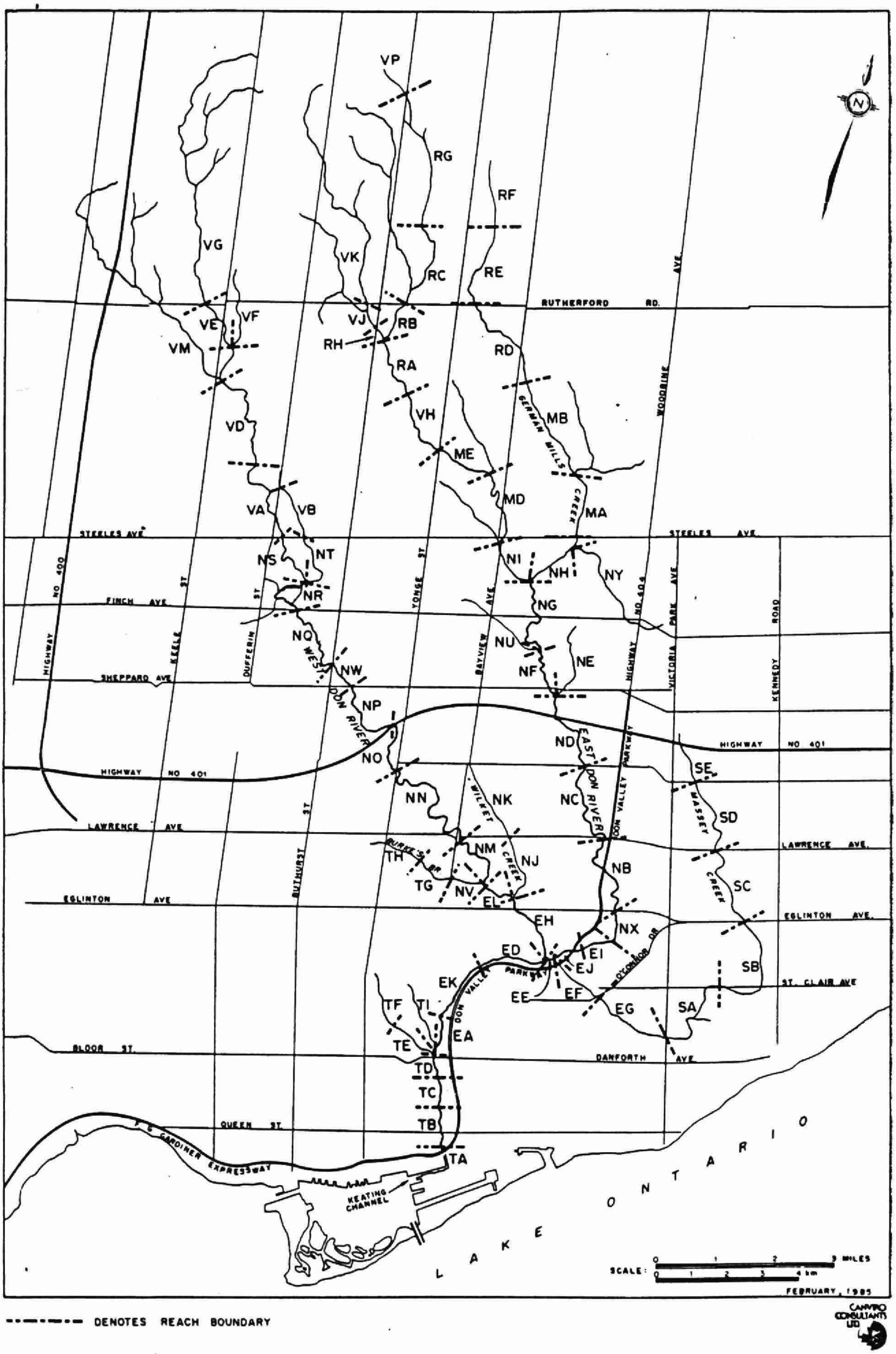
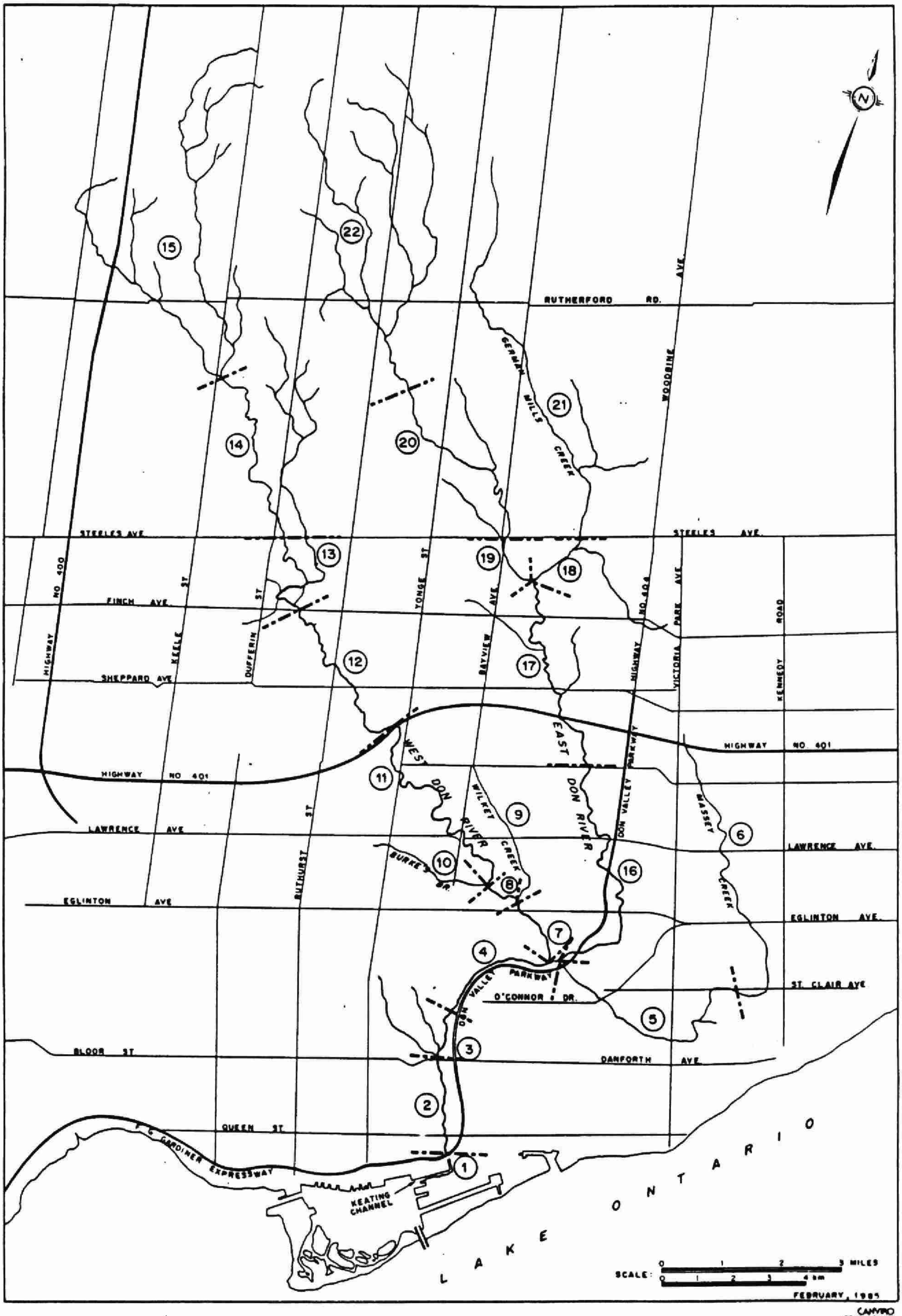


FIGURE 4 — REACH DESIGNATIONS FOR DON RIVER DRY WEATHER OUTFALL SURVEY



DENOTES BOUNDARY OF LOADING SECTION

FIGURE 5 — DON RIVER WATERSHED LOADING SECTIONS

4.2.2 Screening Surveys

During dry days, crews walked in an upstream direction inventorying each outfall encountered. Each visit to an outfall was documented on a field sheet. If the outfall was flowing, samples were obtained and flow and on-site measurements were taken. Similar techniques were employed for each of the screening surveys. Field supervisors accompanied crews during the screening surveys to ensure standardization of procedures.

Determination of Dry Days

On the morning of each working day, river water and outfall samples were collected for the determination of conductivities and classification as to dry (no influence of prior precipitation upon outfall quality) or wet days. For the first month of the field survey, various in-stream locations on the Don River were tested to determine dry weather conductivity levels. A permanent sample station (NA-10) at York Mills Ave. and Don Mills Rd. on the East Don River was ultimately established. Conductivities of dry weather effluent from Outfall ND 1467 were also measured to provide a more immediate indication of precipitation influence. This location was selected because the effluent from the outfall seemed representative of the watershed and access was convenient.

Dry weather conductivity levels were determined to be >650 μmohs/cm for the river and >4500 μmohs/cm for the outfall. During the latter stages of the survey, snow and the salting of roads greatly influenced the outfall conductivities. During these periods, conductivities >9000 μmohs/cm from the outfall were considered to be wet days.

Outfall Documentation

Each outfall was assigned a distinct number which was recorded on a field map carried by the survey crews and on the field sheet. The number was painted on the outfall and the outfall site was photographed. A field sheet was used to document the outfall location, identifying reach, number and the outfall description. An example of a field sheet is presented in Appendix II, as well as a definition of each field sheet item. Documentation of an outfall during the first visit (first or second screening run) was more extensive than subsequent runs in order to reduce needless replication. Differences in documentation between screening runs are presented in Table 4.

TABLE 4. OUTFALL DOCUMENTATION OBTAINED FOR VARIOUS SURVEY RUNS

CATEGORY	RUN ONE	RUN TWO	INTENSIVES
Crew	x	x	x
Date	x	x	x
Time	x	x	x
Outfall Number	x	x	x
Municipal Outfall Number	x	x	x
Stream Name	x	x	x
Reach	x	x	x
Municipality	x	x	x
Street Location	x		
Size	x		
Shape	x		
Material	x		
Mapping	x		
Photograph	x		
Samples	x	x	x
Last Precipitation	x	x	x
Outfall Flow Measurement	x	x	x
Conductivity	x	x	Optional
pH	x	x	Optional
Temperature	x	x	x
Observations	x	x	x

Effluent Sampling

Samples of effluent from active outfalls were obtained for the determination of conventional parameters, bacteria, metals, and when observations warranted (e.g. gasoline odours), phenolic equivalent. Table 5 summarizes the water quality parameters assessed, including the types of sample containers and the methods of sample preservation.

In general, samples were transported in coolers with ice packs during warm weather and were stored in a walk-in cooler at 4°C until submitted for analysis on the next working day. Bacteriological samples were submitted and analyzed within 24 hours of being collected.

TABLE 5. SAMPLE CONTAINERS AND METHOD OF PRESERVATION FOR EACH WATER QUALITY PARAMETER

PARAMETER	SAMPLE BOTTLE DESCRIPTION	METHOD OF PRESERVATION
Biological Oxygen Demand (mg/L) Total Kjeldahl Nitrogen (mg/L) Residue Particulates/ Suspended Solids (mg/L)	1 L Glass	Cooled 4°C
Fecal Coliform Bacteria (org/100 mL) Fecal Streptococcus Bacteria (org/100 mL)	250 mL Glass (sterilized)	Sodium Thiosulphate; Cooled 4°C
Zinc (mg/L) Copper (mg/L) Lead (mg/L) Chromium (mg/L) Iron (mg/L)	500 mL Plastic	10 Drops Concentrated Nitric Acid; Cooled 4°C
Reactive Phenolics (µg/L)	250 mL Glass	Cupric Sulphate; Cooled 4°C

Bacteriological samples were only taken when a sample could be obtained that was uncontaminated with river water and the lip of the sample bottle had not contacted the outfall base or other substances. Field staff were instructed to sample for phenolics if they observed any indication of gas, oil or paint. Whenever possible, samples were obtained directly from flowing effluent. When conditions warranted, various aids were employed in obtaining all but bacteriological samples. Crews were instructed to ensure that any equipment used was thoroughly rinsed with the outfall effluent. Typical aids used included a plastic funnel and beaker, a steel ruler or other flexible device or a reverse suction bicycle pump. A list of equipment used by the field crews is also provided in Appendix II.

All outfalls with flows of greater than approximately .01 L/s were sampled. Below this flowrate, effluent depths were generally too small to permit sample collection.

Outfall Flow Determination

Several methodologies were used to determine outfall flows. Whenever possible, a volume over time estimate was obtained by allowing the effluent to flow into a 1 litre plastic beaker or 4.5 litre pail and recording the fill time with a stop watch. This method was considered most accurate (relative error ± 10-20% of actual volume) and was employed for about 80% of the measurements. If this method was not appropriate, a velocity-area technique was employed to estimate flows. Flow area was obtained by direct measurement or estimation (based on average width and depth) in the case of irregular shaped outfalls. Average flow velocity was estimated by time-of-travel measurements of a floating object over a measured distance. The accuracy of this method was approximately ± 30-50%.

In some instances where measurements were taken in upstream manholes (i.e. submerged outfalls), flow quantities were estimated through application of the Chezy-Manning formula. Pipe slopes were taken from municipal sewer maps and a roughness value of n = 0.013 ($m^{1/6}$) was applied throughout. Due to the variability in condition of the bottom of the pipe, this method was estimated as accurate to ± 50%.

In the event that none of the above methods could be applied, a visual estimate or a combination of a partial measurement and visual estimate was employed to determine flow quantities. The accuracy of a visual estimate is considered to be approximately ± 100%. Methods used to determine flows were recorded on each field sheet.

4.2.3 Selection of Outfalls for Intensive Sampling

Analytical results from the screening run(s) for each outfall were compared with the appropriate modified bylaw limits and if results indicated that one or more parameters were in excess of modified bylaw limits, the outfall was identified as potentially requiring intensive sampling (up to four additional sets of samples and flow measurements). However, due to restrictions in manpower and analytical resources, not all such outfalls could be further surveyed. Accordingly, a scheme for prioritizing the severity of

outfall contamination was developed and only priority outfalls were intensively sampled. For some parameters, selection of the screening criteria were somewhat arbitrary. All screening criteria are summarized in Table 6. Where a loading criteria was specified for a given parameter, the outfall discharge had to exceed both the loading and concentration limits to qualify for intensive sampling.

TABLE 6. SCREENING CRITERIA USED TO IDENTIFY OUTFALLS FOR INTENSIVE SAMPLING

PARAMETER	CONCENTRATION LIMIT	LOAD LIMIT
Fecal Coliform	not specified	>10,000 org/sec
BOD	>15 mg/L	NA
Suspended Solids	>100 mg/L	>1,000 gm/day
Total Phosphorus	>10 mg/L	>100 gm/day
TKN	>20 mg/L	NA
Iron	>1.0 mg/L	>100 gm/day
Chromium	>1.0 mg/L	NA
Lead	>1.0 mg/L	NA
Zinc	>1.0 mg/L	NA
Copper	>1.0 mg/L	NA
Phenols	>20 ug/L	NA
pH	9.5 < pH <6.5	NA
Temperature	>65°C	NA

NA = Not Applicable

Outfalls chosen for intensive surveying were generally assessed for only those parameters which screening runs indicated were above bylaw limits. Other parameters useful in characterizing the discharge were analyzed as needed (if BOD was above bylaw limits, SS and TP were also analyzed; if any metal was above bylaw limits, then all metals were analyzed; if FC was above criteria, then FS analysis was requested).

4.2.4 Intensive Survey Sampling

An attempt was made to visit all outfalls on the intensive list until all parameters in excess of the modified bylaw limits were sampled 4 times. Field crews proceeded directly to the outfall sampled and completed field sheets in the same manner as during the screening runs. Crews were

instructed to sample for additional parameters above those required if a problem was observed. An attempt was made to extend the period between visits, with a minimum interim of one day and maximum of one week.

4.3 Analytical Methods

Sample analysis was conducted by the MOE laboratories in Rexdale up to October 5, 1984 for all parameters. No bacteriological samples were taken on Fridays during this period.

After October 5, the MOE laboratories analyzed only phenolic samples and one set of the triplicated samples which were used for quality assurance. IEC Beak laboratories analyzed all other parameters except bacteria. Bacteriological analyses were sub-contracted to Young and Associates.

A summary of the analytical methods used and detection limits for each laboratory are summarized in Table 7.

4.4 Quality Assurance

Starting on October 5, triplicated samples for conventional and metal analysis were obtained from approximately 1 in 20 sampled outfalls. The variance introduced by sampling was determined by comparing the first and second samples, both analyzed by IEC Beak. The variance introduced by analysis was measured by testing the first sample and the third sample (analyzed by IEC Beak and MOE Rexdale, respectively).

Linear regression of the replicated data was used to determine whether there were significant differences in parameter results introduced by sampling and analysis. Differences between the replicated results were felt to be significant if the linear correlation coefficient r was less than 0.95. The methodology used is taken from the MOE report on the evaluation of inter-laboratory comparison data by linear regression analysis (King, 1976).

On November 26, 1984, an inter-laboratory comparison of bacteriological analysis was performed on outfall effluent between the MOE Laboratories and Young and Associates. Field crews collected 2 litres of effluent. The effluent was divided and distributed and analyses were initiated at exactly the same time.

TABLE 7. ANALYTICAL METHODS AND DETECTION LIMITS FOR WATER QUALITY PARAMETERS AT INDICATED LABORATORIES

PARAMETER	UNITS	ANALYTICAL METHODS AND DETECTION LIMITS					
		IEC BEAK	DETECT. LIMIT	MINISTRY OF ENVIRONMENT	DETECT. LIMIT	R. YOUNG AND ASSOCIATES	DETECT. LIMIT
Biological Oxygen Demand	(mg/L)	(SM) Sub-Oxygen Analyzer	0.2	(SM) Sub-Oxygen Analyzer	0.1	N.A.	-
Total Kjeldahl Nitrogen	(mg/L)	(SM) Kjeldahl Digestion	0.01	(SM) Alkaline Phenol Hypochlorite	0.32	N.A.	-
Residue Particles/ Suspended Solids	(mg/L)	(SM) Residue Suspended Particulate	0.5	(SM) Residue Suspended Particulate	1.0	N.A.	-
Total Phosphorus	(mg/L)	Stannous Chloride Method	0.01	Stannous Chloride Method	0.08	N.A.	-
Fecal Coliform Bacteria	(counts/ 100 mL)	N.A.	-	M-TEC	(variable)	M-TEC	10
Fecal Streptococcus Bacteria	(counts/ 100 mL)	N.A.	-	M-ENT	(variable)	M-ENT	10
Reactive Phenolics	(μg/L)	N.A.	-	4-Aminoantipyrene	0.2	N.A.	-
Zinc	(mg/L)	Direct Current Plasma	0.005	ICAP	0.1	N.A.	-
Copper	(mg/L)	Direct Current Plasma	0.005	ICAP	0.1	N.A.	-
Lead	(mg/L)	Direct Current Plasma	0.01	ICAP	0.1	N.A.	-
Chromium	(mg/L)	Direct Current Plasma	0.01	ICAP	0.1	N.A.	-
Iron	(mg/L)	Direct Current Plasma	0.01	ICAP	0.2	N.A.	-

Note: N.A. = Not Analyzed
SM = Standard Method
ICAP = Inductively Coupled Argon Plasma

Replicated data were analyzed using a one-way analysis of variance of square root transformed colony counts per filter, per parameter from the sample dilution (or aliquot), giving the best parameter recovery (Horsnell and Young, 1984). No significant differences were noted in replicated samples.

4.5 Data Base Management

A computerized data base management system was implemented to house the outfall inventory, analytical results and field measurements. The PC/FOCUS (release 1.0, 1984) software package was employed. Computer hardware included an IBM PC microcomputer provided with a 15 megabyte hard disk and 640K RAM.

The PC/FOCUS program is functionally the same as the FOCUS mainframe program and contains facilities for describing files; for entering, changing and deleting records and preparing reports from the information in the files (Information Builders, 1984).

Files were set up in a multi-segmented file format with a FOCUS suffix. A schematic of the master file segments, their affiliation and their field names within each segment is illustrated in Figure 6. A summary of the master file description and field names used for the survey are provided in Appendix III. A definition of each of these field names is also listed in Appendix III.

Each segment describes either various characteristics of, or observations made, at the outfall. The location segment describes the identification number and locality on the river, while the description segments includes the outfall size and shape in addition to other data. Other segments (e.g. on-site, off-site) contain the date and time of survey, flow, pH and conductivity and all analytical results.

The master file was structured such that records could be sorted by a variety of keys. For example, sorts could be carried out to partition outfalls by municipality and/or reach.

Less than or greater than signs were entered where appropriate, into data fields but were treated as equal signs during computations.

Replicate samples taken on the same day for a given outfall were averaged and treated as a single observation. Outfall concentrations for the period of the study (including all screening runs and intensive sampling) were determined as flow weighted averages. Average pollutant concentrations

```
File Segment Name ───>          LOCATION
File Segment ──────> 01         S3
                    **************
                   **MUNICIPALITY**
                   **REACH       **
Fields within ───> **OUTFALL NUM **
Each Segment       **MO-NUMBER   **
                   **            **
                   ****************
                   ****************
                           I
                           I
                           I DESCRIPT
                     02    I S1
                    **************
                   **OUTFALL-TYPE**
                   **PIPE-DIM-1  **
                   **PIPE-DIM-2  **
                   **DESCRIPTION **
                   **            **
                   ****************
                   ****************

                           I
                           I
                           I ONSITE
                     03    I S1
                    **************
                   **DATE        **
                   **TIME        **
                   **LAST PRECIP **
                   **CREW        **
                   **            **
                   ****************
                   ****************
                           I
                           I
                           I OFFSITE
                     04    I S1
                    **************
                   **REPLICANT   **
                   **RTP         **
                   **TOT P       **
                   **RTKN        **
                   **            **
                   ****************
                   ****************
```

FIGURE 6. SCHEMATIC OF MASTER FILE USED FOR DON RIVER OUTFALL SURVEY

calculated for a reach, loading section or the river as a whole were in turn computed as the flow weighted averages of the individual outfall average qualities (also flow weighted).

4.6 Mapping Procedures

Large scale (1:2000) floodline maps of the Don River and tributaries were obtained from the Metro Toronto and Region Conservation Authority for use in the field. The precise location of each outfall was marked on these maps. Alternate maps were required for those tributaries not covered by the floodline maps. Reaches on the Little Don River in Richmond Hill were surveyed using a 1:10,000 municipal map. Tributaries west of Keele St. were inventoried on a 1:15,000 Town of Vaughan municipal map. Massey Creek north of Lawrence was surveyed using a 1:10,000 Scarborough municipal map.

Aerial photographs (1978 south of Steeles, 1983 north of Steeles) were used to assist field crews in the location of outfalls and mapping.

The location of each outfall was recorded on 1:10,000 municipal grid coordinated road maps that were obtained from the Metropolitan Toronto Mapping Service for the reaches within Metropolitan Toronto and from each municipality for areas north of Steeles. Mylars of these maps were produced and individual reaches separated such that individual reach maps with the location of each outfall within that reach were produced.

4.7 Classification of Outfalls

Outfalls were classified to assist the municipalities and the Ministry in prioritizing "problem outfalls" (i.e. outfalls with one or more parameters exceeding modified bylaw limits).

Figure 7 presents a schematic diagram of the classification scheme employed. Based upon this scheme, outfalls were placed in one of four categories as follows:

Group A Outfalls

Outfalls sampled four or more times and exceeding modified bylaw limits were categorized as Group A outfalls.

The above classification was carried out on a parameter by parameter basis. Thus, an outfall may be a Group A outfall only for certain parameters and be a Group B outfall, etc. for others.

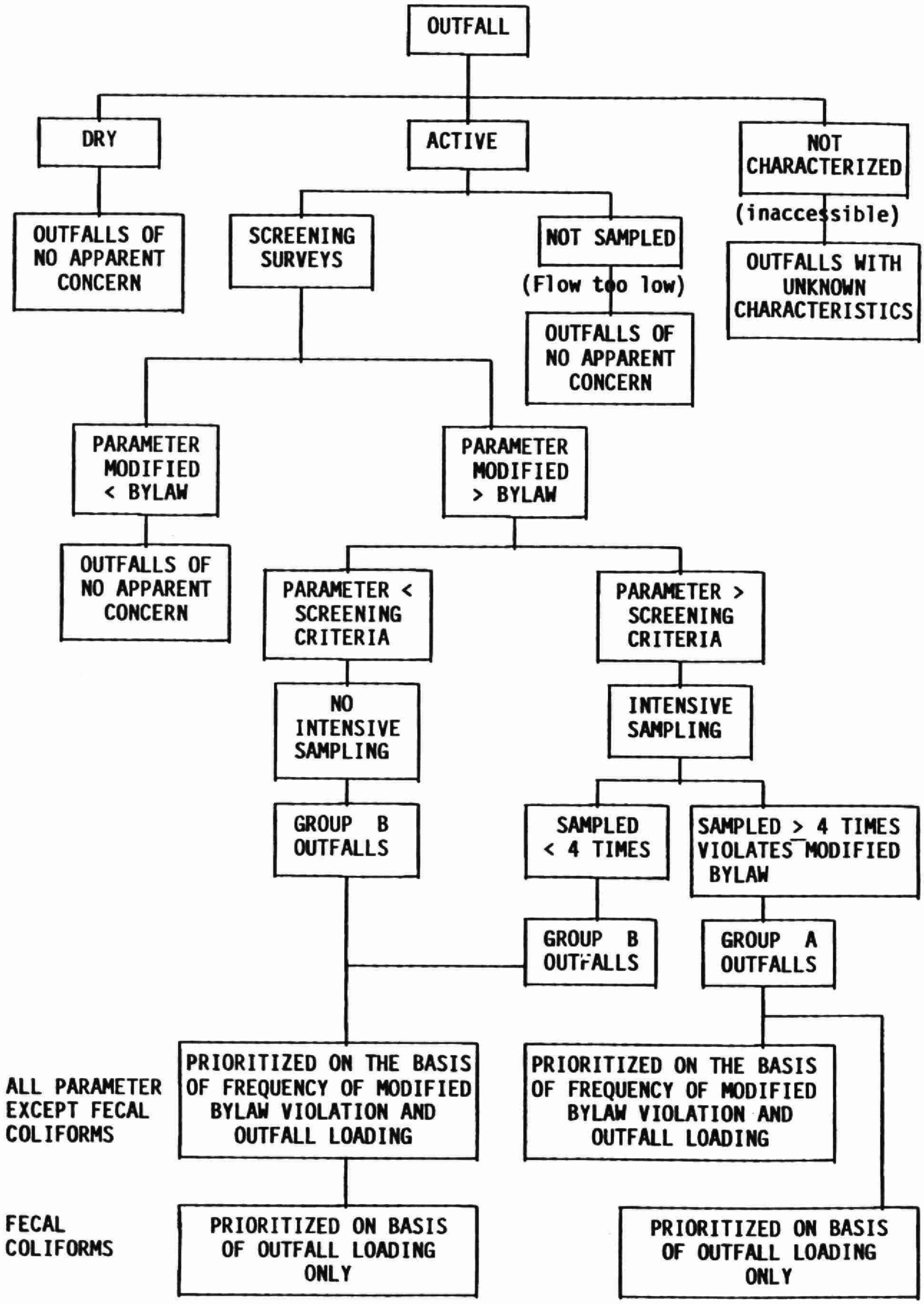


FIGURE 7. SCHEMATIC OF OUTFALL CLASSIFICATION

The problems associated with Group A outfalls were felt to be, in general, sufficiently well defined to determine whether future abatement action was required.

Group B Outfalls

Group B outfalls included those in which one or more parameters were greater than modified bylaw limits, but information was not adequate to fully define typical outfall quality (i.e. less than 4 observations). For the most part, these outfalls were initially (based on screening run data) of less concern than those of Group A. Group B outfalls were also classified by parameter.

In general, Group B outfalls would require further outfall sampling prior to initiating abatement actions.

Outfalls of No Apparent Concern

Outfalls deemed to be of no apparent concern included those outfalls which were dry or non-active and those which at no time during the survey was an analytical parameter greater than modified bylaw. In addition, active outfalls in which flows were too low to permit sampling were somewhat arbitrarily categorized as being of no apparent concern. No follow-up action is recommended for outfalls of no apparent concern.

Outfalls with Unknown Characteristics

Outfalls which could not be surveyed due to inaccessibility (e.g. submerged) were placed in this final category.

It is suggested that, wherever evidence exists that these outfalls may possess significant inputs (e.g. based on in-stream observations), appropriate efforts be mounted to characterize flows.

5.0 RESULTS AND DISCUSSION

A printout of the complete Don River data base is provided in a separate volume in Appendix VIII. In addition, in order to facilitate location of outfalls, copies of all field data sheets and outfall photographs have been provided in Appendices VII and IX, respectively. Both appendices are provided in separate volumes.

5.1 Timetable of Survey Activities

A summary of the project timetable is presented in Figure 8. CANVIRO staff conducted the field work in the municipalities of Markham, North York, Richmond Hill and Vaughan. Municipal crews carried out the bulk of the work in East York, Scarborough and the City of Toronto. Analytical restrictions prevented the municipal crews from initiating field activities until after October 5, 1984. The late start of field activities and manpower limitations produced some difficulties in completing the work within the prescribed schedule. This necessitated assistance of CANVIRO staff in Toronto and East York and extension of the program by two weeks. Intensive surveys of East York outfalls were carried out subsequent to the main program during the period August to October of 1985.

5.2 Outfall Inventory

A summary of the outfall inventory, organized by municipality, is provided in Table 8. Details of the type and number of outfalls in each study reach are presented in Appendix V. As well, the location of each outfall on the river is presented in the individual reach maps provided in Appendix I.

In total, 1423 outfalls were located and inventoried on the Don River and its tributaries. Separated storm sewer outfalls accounted for 1184 pipes or 83% of the total number of outfalls. A total of 30 (2.2% of the total number of outfalls) combined sewer outfalls were identified as well as one industrial outfall in Reach TB. The remainder of the outfalls were comprised of 112 minor tributaries and 95 drainage ditches (8% and 7% of the total number of outfalls, respectively).

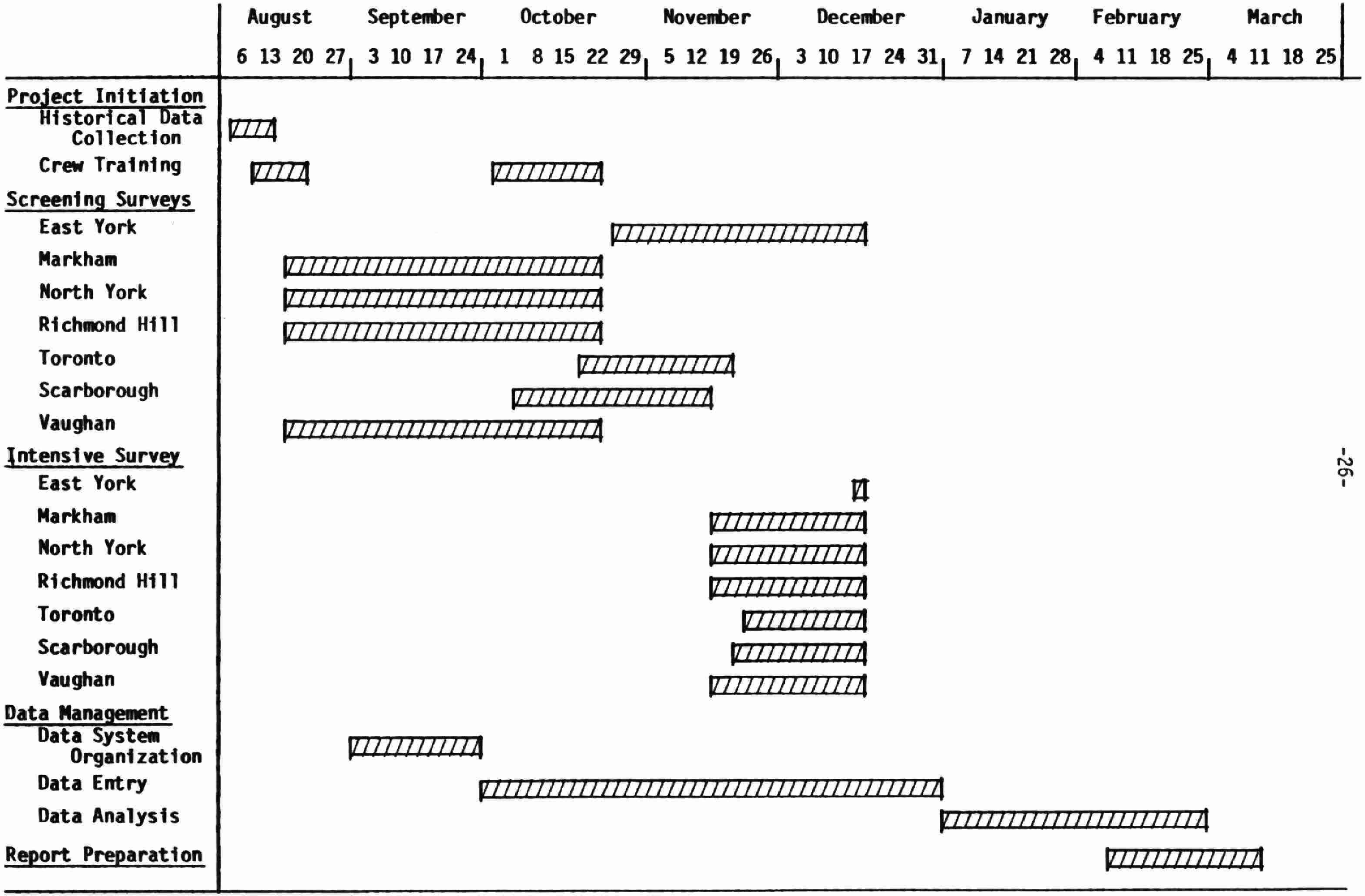


FIGURE 8. TIME TABLE OF SURVEY ACTIVITIES

TABLE 8. SUMMARY OF OUTFALL INVENTORY ON THE DON RIVER

MUNICIPALITY	OUTFALL STATUS	STORM SEWER OUTFALL	COMBINED SEWER OUTFALL	TRIBUTARIES	DITCHES	TOTAL
Toronto	Flowing (1)	38(4)	14	0	2	54
	Dry (2)	21	5	0	2	28
	Submerged (3)	5	0	0	0	5
	Not Surveyed	20	0	0	0	20
Total		84	19	0	4	107
East York	Flowing (1)	88	2	4	0	94
	Dry (2)	68	0	2	5	75
	Submerged (3)	1	1	1	0	3
Total		157	3	7	5	172
North York	Flowing (1)	246	0	38	1	285
	Dry (2)	193	0	17	8	218
	Submerged (3)	13	0	0	0	13
Total		451	0	55	9	516
Scarborough	Flowing (1)	72	6	0	2	80
	Dry (2)	108	2	1	15	126
	Submerged (3)	0	0	0	0	0
Total		180	8	1	17	206
Markham	Flowing (1)	59	0	5	1	65
	Dry (2)	60	0	6	12	78
	Submerged (3)	4	0	0	0	4
Total		123	0	11	13	147
Richmond Hill	Flowing (1)	45	0	11	3	59
	Dry (2)	51	0	17	25	93
	Submerged (3)	8	0	0	0	8
Total		104	0	28	28	160
Vaughan	Flowing (1)	40	0	8	4	52
	Dry (2)	40	0	2	16	58
	Submerged (3)	5	0	0	0	5
Total		85	0	10	20	115
GRAND TOTAL		1185	30	112	96	1423

<u>Note:</u> (1) - Effluent discharging from outfall on any given visit.
(2) - Effluent never discharged from outfall on any visit.
(3) - Outfall was submerged in river water.
(4) - Includes one industrial outfall.

A breakdown of the percentage of outfalls within each municipality is presented in Figure 9. North York had by far the largest percentage of the total number of outfalls with 515 or about 37%. The City of Toronto possessed the fewest outfalls with 106 or approximately 7%.

A total of 49% of all outfalls (687 outfalls) were found to have some flow on any visit. This total excludes the 39 (approximately 2% of all outfalls) outfalls which were submerged by river water and were not sampled. The majority of the submerged outfalls were located within the Toronto, East York and North York reaches.

In addition to the submerged outfalls, it was not possible to survey 20 outfalls in the lower reaches of the Don River (TA, TB, TC). These outfalls were adjacent to the Don Valley Parkway and the Keating Channel which limited access from either the river banks or from an upstream manhole.

5.3 Sampling Summary

A summary of the number of outfalls sampled in each municipality is listed in Table 9 and is presented by reach in Appendix V. A total of 587 (42% of surveyed outfalls) were sampled during the screening runs. Of the sampled outfalls, 345 (59%) were sampled at least twice. Reasons for outfalls being sampled only once included:

(1) Limited laboratory capacity during the initial portion of the survey.

(2) The outfall may have only been found during the second screening run.

(3) The outfall may have been non-active during one of the screening runs.

Some outfalls were sampled twice, but have only one set of bacteriological data from the screening surveys. As previously noted, bacteriological samples were not taken on Fridays during the early portion of the study.

A total of 169 outfalls or 29% of sampled outfalls were intensively surveyed. Storm sewer pipes comprised the majority of outfalls sampled

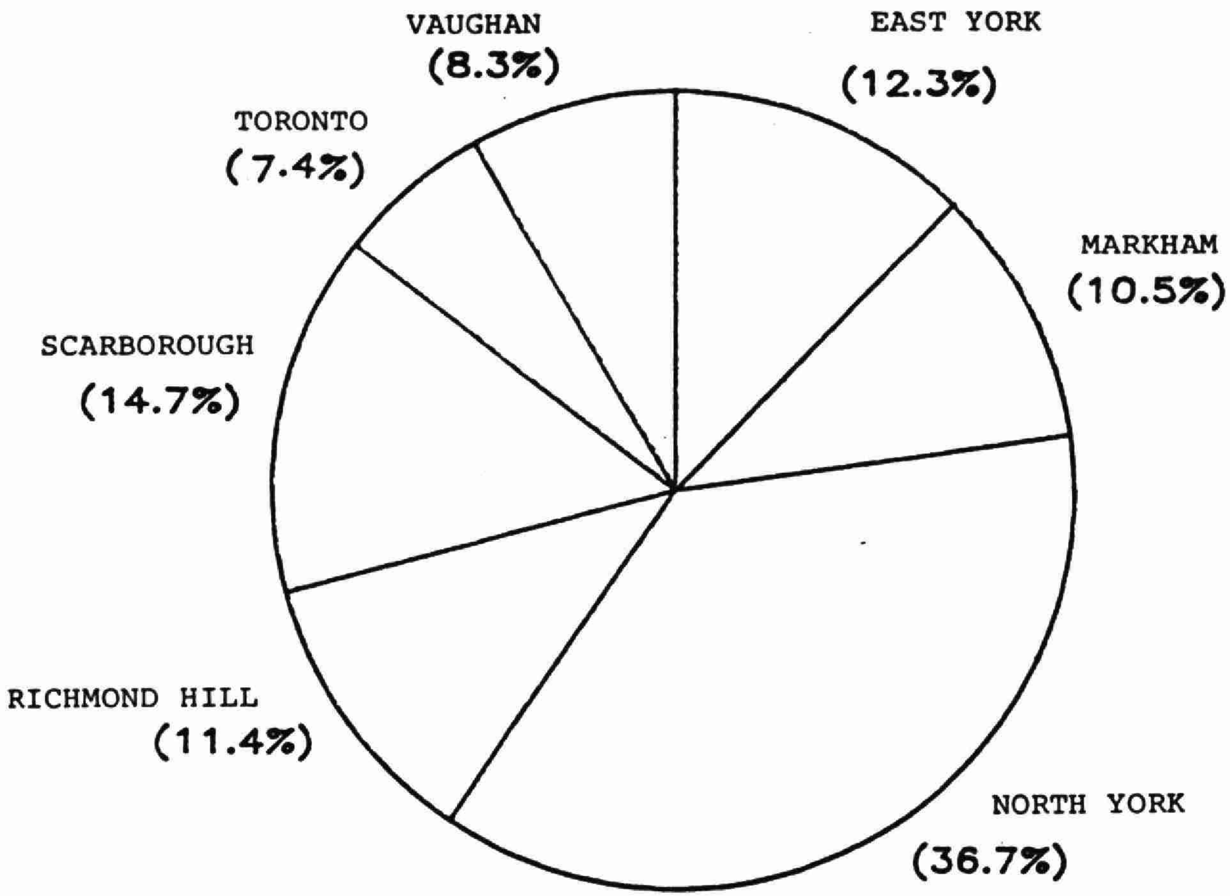


FIGURE 9. DISTRIBUTION OF OUTFALLS BY MUNICIPALITY

TABLE 9. SUMMARY OF OUTFALLS SAMPLED FOR WATER QUALITY DURING DON RIVER OUTFALL SURVEY

MUNICIPALITY	NUMBER OF TIMES SAMPLED	STORM SEWER OUTFALL	COMBINED SEWER OUTFALL	TRIBUTARIES	DITCHES	TOTAL
Toronto	Once (SR)	16	1	0	1	18
	Twice (SR)	14	12	0	1	27
	Total (SR)	30	13	0	2	45
	Intensively	7	6	0	0	13
East York	Once (SR)	22	0	2	0	22
	Twice (SR)	52	1	2	0	55
	Total (SR)	74	1	2	0	77
	Intensively	22	1	2	0	25
North York	Once (SR)	104	0	20	0	124
	Twice (SR)	123	0	14	0	137
	Total (SR)	227	0	34	0	261
	Intensively	70	0	2	0	72
Scarborough	Once (SR)	23	1	0	1	25
	Twice (SR)	47	4	0	1	52
	Total (SR)	70	5	0	2	77
	Intensively	35	1	0	1	37
Markham	Once (SR)	25	0	4	0	29
	Twice (SR)	25	0	0	0	25
	Total (SR)	50	0	4	0	54
	Intensively	5	0	0	0	5
Richmond Hill	Once (SR)	9	0	2	1	12
	Twice (SR)	21	0	6	0	27
	Total (SR)	30	0	8	1	39
	Intensively	11	0	2	0	13
Vaughan	Once (SR)	9	0	2	1	12
	Twice (SR)	19	0	3	0	22
	Total (SR)	28	0	5	1	34
	Intensively	3	0	1	0	4
TOTAL SAMPLED SCREENING RUNS		509	19	53	6	587
TOTAL SAMPLED INTENSIVELY		153	8	7	1	169

SR = Screening Runs

intensively (91%). Only 5% of the intensively sampled outfalls were CSOs; although, this represented 42% of all sampled CSOs. The remainder of intensively sampled outfalls consisted of tributaries (4%) and ditches (<1%). The majority of intensively sampled outfalls were located in North York (43%) and Scarborough (22%).

5.4 Summary of Outfall Flow Quantity

A summary of the average total effluent discharge into each loading section is provided in Table 10 and is summarized by reach in Appendix V. The total measured discharge into the Don River was 1.65 m^3/s. Twenty-five percent of the measured discharge was observed in Section 4. The North Toronto Water Pollution Control Plant accounted for 93% (397 L/s) of the discharge in this section and was, by far, the single greatest discharger (24%) to the river. Sections 20, 21 and 22, in the upper reaches, contained tributaries which increased the amount of discharge to these sections. Sections 1 and 8 had the lowest observed discharges (.3 and .1 L/s, respectively). These sections each contain only one known active outfall. The single industrial discharger (outfall TB 79) is included in the total for loading Section 2. The discharge quantity from this outfall was quite small (.5 L/sec) and accounted for less than 1% of the total flow volume in this section. The majority of the sections had measured discharges in the range of 20-90 L/s.

5.5 Quality Assurance

5.5.1 Variance Attributable to Sampling

Based on regression analysis, the majority of parameters showed no significant differences attributable to sampling (i.e. $r \geq 0.95$) in the replicated data. Exceptions were total phosphorus ($r = 0.81$), iron ($r = 0.93$) and lead ($r = 0.93$). Detailed results of the regression analyses and the resulting regression equations are presented in Appendix IV.

5.5.2 Analytical Differences Between Laboratories

Linear regressions of the replicated analytical (conventional plus metals) data from the two laboratories (MOE and IEC Beak) are also provided in Appendix IV. Based upon the regression analyses, significant differences

TABLE 10. SUMMARY OF TOTAL AVERAGE DISCHARGE INTO EACH LOADING SECTION ON THE DON RIVER

SECTION	SUM OF AVERAGE FLOW (L/s)
1	.3
2	58.9
3	49.8
4*	15.3
4-North Don WPCP	397.0
5	51.1
6	88.3
7	30.1
8	0.1
9	33.3
10	70.6
11	29.2
12	27.6
13	51.8
14	60.3
15	47.3
16	82.6
17	51.4
18	26.1
19	20.6
20	116.8
21	137.0
22	205.4
TOTAL EXCLUSIVE OF NORTH TORONTO WPCP	1252.9
GRAND TOTAL	1649.9

* Exclusive of the North Don WPCP.

(correlation coefficient r <0.95) in replicated data were observed for all parameters except SS and chromium. Specific reasons for this are not apparent at this time; however, the differences in procedures and detection limits between the two laboratories should be recognized.

5.5.3 Microbiological QA

The results of the one-way Analysis of Variance conducted for fecal coliform and fecal streptococcus parameters are provided in Appendix IV. No significant difference was determined between the two laboratories in the analysis of replicated data for any parameter.

5.6 Average Pollutant Concentrations

The average flow weighted concentrations of selected pollutant parameters for all flowing outfalls including the North Don effluent are presented in Table 11. North Toronto WPCP effluent quality data are presented separately.

TABLE 11. SUMMARY OF OUTFALL AVERAGE FLOW WEIGHTED POLLUTANT CONCENTRATIONS

PARAMETER	AVERAGE OUTFALL * CONCENTRATION	NORTH TORONTO WPCP	MODIFIED BY-LAW LIMIT
Fecal Coliform	44,300 org/100 mL	34 org/100 mL	not specified
Fecal Streptococcus	4,900 org/100 ml	NA	NA
BOD	3.0 mg/L	14.7 mg/L	15 mg/L
Total Phosphorus	0.4 mg/L	0.8 mg/L	1 mg/L
Suspended Solids	7.2 mg/L	8.3 mg/L	15 mg/L
TKN	0.4 mg/L	NA	20 mg/L
Lead	0.01 mg/L	0.04 mg/L	1 mg/L
Zinc	0.01 mg/L	0.07 mg/L	1 mg/L
Copper	0.01 mg/L	0.04 mg/L	1 mg/L
Chromium	0.02 mg/L	<0.01 mg/L	1 mg/L
Iron	0.34 mg/L	0.46 mg/L	1 mg/L
Phenolics	1.8 ug/L	NA	20 ug/L

Note: * Includes North Toronto WPCP effluent except for fecal streptococcus, phenolics and TKN results.

North Toronto WPCP effluent data was obtained from plant records. An average flow weighted effluent quality for the period from July to December was used to characterize the WPCP discharge. North Toronto data did not include FS, TKN or phenol analyses.

As is evident from Table 11 data, the average quality of outfall discharges, with the exception of bacterial parameters, was generally good. The North Toronto WPCP produced a high quality effluent during this period, characteristic of a well-operated secondary facility with chemical phosphorus removal.

Tables 12, 13 and 14 provide summaries of average discharge concentrations observed in each loading section for fecal bacteria, conventional parameters and phenols and heavy metals, respectively. Average concentration data for study reaches and for individual pipes ranked by loading are provided in Appendix VIII. Detailed discussion of worst/best sections, reaches and pipes with respect to individual parameters is presented in the following report section dealing with outfall loadings. It was felt that from the standpoint of impact on the Don River, water quality loadings were a more meaningful problem indicator. Indeed, in some cases, sections, reaches and pipes with substantial pollutant concentrations may have had limited flows and, as a result, did not contribute significantly to pollutant loadings. Equally, sections, reaches and pipes with average concentrations below the modified bylaw criteria, but with substantial discharge volumes, produced significant loads.

5.7 Outfall Pollutant Loadings

The following discussion of outfall loadings is centered on observed loading values for the sections identified in Figure 5 and Table 3 and the North Toronto WPCP. Individual outfalls contributing significant loads are highlighted where possible. Otherwise, data regarding reach and individual pipe loadings is presented in detail in Appendix VIII. It should be noted that loadings are accurate to an order of magnitude of the reported values, given sampling and discharge measurement error that is inherent in this type of study.

TABLE 12. SUMMARY OF SECTION GEOMETRIC MEAN BACTERIAL DENSITIES

SECTION	FECAL COLIFORM (org/100 mL)	FECAL STREPTOCOCCUS (org/100 mL)
1	3.17×10^4	8.27×10^2
2	1.95×10^6	3.48×10^4
3	1.39×10^4	7.4×10^3
4*	5.07×10^3	10.7×10^2
NT WPCP	3.40×10^1	NA
5	3.01×10^4	5.3×10^3
6	2.07×10^5	9.22×10^3
7	5.50×10^4	1.61×10^4
8	2.58×10^2	1.39×10^2
9	1.05×10^4	2.46×10^3
10	5.86×10^3	5.72×10^3
11	8.44×10^4	1.87×10^3
12	3.33×10^3	2.02×10^3
13	1.32×10^4	3.57×10^3
14	1.26×10^4	9.45×10^2
15	1.75×10^4	1.92×10^3
16	1.35×10^4	8.52×10^3
17	2.33×10^4	3.47×10^3
18	5.93×10^4	3.34×10^4
19	7.45×10^4	6.43×10^3
20	4.46×10^3	1.08×10^3
21	3.61×10^3	2.85×10^3
22	7.84×10^2	1.47×10^3

Note: * Exclusive of North Toronto WPCP.

TABLE 13. SUMMARY OF SECTION AVERAGE CONCENTRATIONS FOR CONVENTIONAL PARAMETERS AND PHENOLS

SECTION	BOD (mg/L)	SUSPENDED SOLIDS (mg/L)	TOTAL PHOSPHORUS (mg/L)	TKN (mg/L)	PHENOL (ug/L)
1	40.7	93.2	0.6	1.5	2.2
2	34.1	61.0	0.9	2.7	29.2
3	2.6	17.7	0.1	0.6	1.2
4*	13.8	4.8	0.1	2.0	2.1
NT WPCP	14.7	8.3	0.8	NA	NA
5	2.9	10.0	0.2	1.2	5.2
6	16.4	18.2	2.4	1.1	2.4
7	28.5	13.9	0.4	1.7	211.6
8	0.4	3.9	0.1	0.5	0.0
9	1.9	3.1	0.2	1.7	1.1
10	1.0	113.2	0.4	0.8	0.4
11	2.2	128.4	0.4	0.6	4.2
12	2.5	6.7	0.2	0.7	0.4
13	30.4	41.0	53.9	3.5	9.1
14	1.4	25.5	0.2	0.7	1.2
15	1.6	11.2	0.1	0.6	0.5
16	8.7	18.7	0.6	1.7	18.0
17	4.1	25.9	0.2	1.8	36.1
18	2.9	17.4	0.2	1.3	1.5
19	2.7	7.0	0.4	2.6	0.4
20	2.6	11.6	0.1	0.6	0.6
21	1.0	8.6	0.1	0.3	0.7
22	1.3	125.3	0.2	1.0	3.4
Modified Bylaw Limit	15	15	1	NA	20

Note: * Exclusive of North Toronto WPCP effluent.

TABLE 14. SUMMARY OF SECTION AVERAGE CONCENTRATIONS FOR HEAVY METALS

SECTION	ZINC (mg/L)	LEAD (mg/L)	COPPER (mg/L)	CHROMIUM (mg/L)	IRON (mg/L)
1	0.20	0.23	0.10	0.10	4.4
2	0.13	0.15	0.06	0.21	2.5
3	0.03	0.05	0.01	0.02	0.83
4	0.07	0.04	0.01	0.02	0.45
NT WPCP	0.07	0.04	0.04	<0.01	0.35
5	0.04	0.09	0.01	0.03	0.51
6	0.17	0.07	0.04	0.06	1.8
7	0.07	0.05	0.08	0.02	0.66
8	0.13	0.13	0.00	0.00	3.0
9	0.05	0.05	0.01	0.02	0.15
10	0.04	0.06	0.02	0.03	5.8
11	0.03	0.05	0.02	0.03	4.3
12	0.03	0.03	0.02	0.02	0.32
13	0.08	0.07	0.94	0.02	1.1
14	0.03	0.03	0.01	0.02	3.7
15	0.03	0.02	0.01	0.01	0.55
16	0.09	0.12	0.02	0.08	1.9
17	0.04	0.04	0.02	0.09	1.1
18	0.06	0.05	0.01	0.01	0.43
19	0.04	0.03	0.01	0.01	0.45
20	0.02	0.02	0.01	0.02	0.49
21	0.02	0.04	0.01	0.01	0.81
22	0.06	0.03	0.02	0.01	11.00
Modified Bylaw Limit	1	1	1	1	1

5.7.1 Bacterial Loadings

Table 15 presents the measured loadings of fecal bacteria.

Fecal Coliform

A substantial net FC loading (inclusive of the North Toronto WPCP) of 1.63×10^9 org/sec was measured entering the Don River. Approximately 78% of this load was measured within section 2 which in contrast had a volumetric discharge of only 3.6% of the total volume. Some of the worst effluent quality outfalls occurred in this section with FC loads on the order of 10^7 to 10^8 org/sec (outfalls TB 27, TB 20, TB 36, TC 47 and TC 40). Two of these outfalls, TC 47 and TC 40, are CSOs. Outfalls EF 1904, EG 290 and EG 291 are the highest single contributors, with loads of over 1 million organisms per sec. The North Toronto WPCP, because of very low effluent densities, was not a significant FC source (<.01%).

Fecal Streptococcus

Fecal streptococcus loadings were approximately one order of magnitude lower than those observed for fecal coliforms. In general, the distribution of loadings by section was similar to that of fecal coliforms. No FS data was available for the North Toronto WPCP.

5.8.2 Loadings of Conventional Pollutants and Phenols

Table 16 presents the loadings of conventional parameters and phenols for each loading section and the North Toronto WPCP effluent.

BOD

The total BOD input into the Don River was measured to be 1,250,957 gm/day. The North Toronto WPCP was the single largest BOD contributor with an average loading of 504,209 gm/day or 40% of the net total measured from all sources.

TABLE 15. SUMMARY OF SECTION BACTERIAL LOADINGS

SECTION	FECAL COLIFORM (org/sec)	FECAL STREPTOCOCCUS (org/sec)
1	1.13×10^5	2.32×10^3
2	1.15×10^9	2.05×10^7
3	6.94×10^6	3.70×10^6
4	7.76×10^5	1.64×10^5
NT WPCP	1.35×10^5	NA
5	1.54×10^6	2.68×10^6
6	1.83×10^8	8.14×10^6
7	1.66×10^7	4.86×10^6
8	2.58×10^2	1.40×10^2
9	3.51×10^6	8.20×10^5
10	4.14×10^6	4.03×10^6
11	2.47×10^7	5.46×10^5
12	9.19×10^5	5.58×10^5
13	6.82×10^6	1.85×10^6
14	7.57×10^6	5.70×10^5
15	8.29×10^6	9.07×10^5
16	1.12×10^7	7.04×10^6
17	1.20×10^7	1.78×10^6
18	1.55×10^7	8.72×10^6
19	1.53×10^7	1.33×10^6
20	5.21×10^6	1.26×10^6
21	4.95×10^6	3.90×10^6
22	1.61×10^6	3.02×10^6
TOTAL	1.48×10^9	7.64×10^7

TABLE 16. SUMMARY OF SECTION LOADINGS FOR CONVENTIONAL PARAMETERS AND PHENOLS

SECTION	BOD (gm/day)	SUSPENDED SOLIDS (gm/day)	TOTAL PHOSPHORUS (gm/day)	TKN (gm/day)	PHENOL (gm/day)
1	1,063	2,411	16	40	<.1
2	173,025	310,427	4,580	13,740	148
3	11,359	76,029	430	2,711	5.1
4	18,240	6,208	183	2,581	2.8
NT WPCP	504,209	284,689	28,126	NA	NA
5	12,746	43,666	705	5,993	23
6	125,118	137,324	18,310	8,392	18
7	73,988	36,019	1,066	4,421	389.5
8	3	34	1	4	0
9	5,409	8,948	460	4,920	3.1
10	5,795	689,928	2,501	4,575	2.6
11	5,500	323,837	908	1,463	11
12	5,962	15,977	382	1,717	0.9
13	140,576	183,273	241,365	15,709	41
14	7,085	133,061	834	3,386	6.1
15	6,457	45,853	409	7,070	1.9
16	61,875	133,384	3,225	12,346	128.4
17	18,208	115,465	711	7,994	160
18	6,517	39,305	519	2,886	3.3
19	6,156	12,388	641	4,663	0.6
20	26,238	121,098	1,413	5,954	5.7
21	11,837	101,796	710	3,669	8.6
22	23,591	2,223,094	3,015	18,243	59
TOTAL	1,250,957	5,044,214	310,510	132,477*	1018.6*

Note: * Partial Loading; does not include North Toronto WPCP.
NA = Not Available

Major outfall loadings of BOD occurred in sections 2, 6 and 13 which, collectively, contributed 35% of the total loading.

Section 2 in the lower river reaches (TB and TC) contained several major contributing outfalls (TB 20, 27 and 28) with typical loads of between 50,000 and 72,000 gm/day. All of these outfalls, exceeded modified bylaw concentrations on one or more occasion. Outfalls TB 20 and TB 27 exceeded modified bylaw limits on 5 of 5 and 6 of 6 instances, respectively. In section 6, located in the upper reaches of Massey Creek, outfalls SC 421, SC 472 and SC 1800 all discharged loads of between 18,000 and 25,000 gm/day of BOD. Outfalls SC 421, and SC 472 exceeded modified bylaw limits 5 out of 6 times, while outfall SC 1800 exceeded the limits a total of 3 out of 6 times. Outfall NR 1162, in section 13, discharged a typical load of about 131,000 gm/day and was the second largest single BOD contributor after the North Don WPCP. BOD concentrations observed at this outfall, however, were in excess of modified bylaw limits on only one occasion.

Outfall EH 162 was also a significant contributor of BOD with a loading of about 86,000 gm/day. Modified bylaw exceedences were observed on all three occasions that the outfall was visited.

Suspended Solids

The total measured input of suspended solids into the Don River was on the order of 5.0 x 10^6 gm/day. One outfall, RG 944, in section 22 was responsible for 36% of the total measured SS input. Construction was observed upstream of this outfall and it is believed to be the cause of the excessive solids loadings. Effluent from Burkes Brook (section 10) accounted for an additional 14% of the total input of SS. Outfall TH 131 was the major discharger to the brook, contributing an average of about 650,000 grams of SS per day. In both the above cases the outfalls were, in reality, minor tributary streams and it is not clear whether modified bylaw limits would be applicable. Nevertheless, for the sake of consistency, these "outfalls" are subsequently classified into one of the four categories indicated in section 4.7.

The North Toronto WPCP contributed an average discharge of 280,000 gm/day or 6% of the total SS load into the river.

Total Phosphorus

A total of 310,510 gm/day of total phosphorus was measured entering the Don River. Outfall NR 1164, in section 13, accounted for 79% of the total measured phosphorus loadings. Several problems were noted by crews at this outfall including the odour of detergent and paint, petroleum residue and a brown soapy foam on the effluent surface. Total P concentrations observed at this outfall violated modified bylaw limits for phosphorus on 3 of 6 visits. Outfall NR 1164 is a minor Don River tributary. The excessive total P concentrations other observations suggest, however, inputs from the adjacent industrial area.

The North Toronto WPCP accounted for only 9% of the total phosphorus load.

TKN

A TKN input (exclusive of the North Toronto WPCP) of about 132,000 gm/day was observed. The highest average loading of TKN originated from outfall RG 944 in Section 22; it accounted for 10% of the total load. Outfall RG 944 TKN concentrations did not violate modified bylaw criteria on any visit. Although, on one of three outfall samplings, a relatively high TKN concentration of 10 mg/L was detected.

Outfalls TB 27 and TB 36, in section 2, also possessed substantial TKN loads and exceeded modified bylaw criteria on 6 of 6 and 4 of 6 occasions, respectively.

No TKN data was available for the North Toronto WPCP.

Phenol

An average daily load of 1017 gm/day of phenol was measured. Effluent from outfall EH 162 accounted for 38% of the total phenol load. This outfall violated modified bylaw limits for phenols on 2 of 4 samples. Outfall TB 27 was also above modified bylaw limits on 4 of 6 visits and accounted for 4.0% of the total load.

No phenol data for the North Toronto WPCP was available.

5.7.3 Heavy Metal Loadings

Table 17 summarizes heavy metal loadings by section. North Toronto WPCP effluent loadings are included for purposes of comparison.

Zinc

The total measured load of zinc into the Don River was 8272 gm/day. The North Toronto WPCP was the single largest zinc contributor discharging 31% of the total daily load. Outfalls RG 944, in section 22, and SB 368, in section 6, were the next highest sources contributing 11% and 8%, respectively. Outfall SB 368 violated modified bylaw limits in 4 of 4 samples. In contrast, outfall RG 944 did not exceed modified bylaw limits on any occasion.

Lead

Lead loadings were estimated to be 7135 gm/day. The single largest contributor was again the North Toronto WPCP which discharged 19% of the total load. Otherwise, the highest lead loadings were observed in sections 16, 2 and 22 which accounted for 12%, 11% and 17% of the total lead input, respectively. Outfalls NC 1438 and NC 1439, in section 16, had a combined average load of 627 gm/day of lead. (These are twin outfalls which may be inter-connected.) Modified bylaw limits were, however, exceeded on only 1 of 6 samplings. Outfalls TB 28 and TC 40, sn Section 2, also had high average lead loads of 416 and 166 gm/day, respectively. Concentrations were, however, not above modified bylaw limits for either outfall on any occasion. Outfalls RE 636, in section 21, and RG 944, VJ 901 and VK 903, in section 22, had relatively low lead concentrations, but high loads due to high discharge volumes.

Copper

A copper load of 7689 gm/day was observed. Outfall NR 1254, in section 13, accounted for 63% of the total copper load. The result is somewhat unreliable since it is based upon a single sampling which yielded an outfall concentration of 28 mg/L of copper. Otherwise, there were no outfalls observed which were consistently above modified bylaw limits. The North Toronto WPCP accounted for 18% of the total copper load.

TABLE 17. SUMMARY OF SECTION LOADINGS FOR HEAVY METALS

SECTION	ZINC (gm/day)	LEAD (gm/day)	COPPER (gm/day)	CHROMIUM (gm/day)	IRON (gm/day)
1	5	6	3	3	113
2	662	763	305	1069	12,722
3	129	214	43	86	3,571
4	93	53	13	26	596
NT WPCP	2401	1372	1372	343	12,005
5	176	396	44	132	2,448
6	1297	534	305	458	13,488
7	182	130	208	52	1,716
8	1	1	0	0	26
9	144	144	29	58	432
10	244	366	122	183	35,501
11	76	126	50	76	10,874
12	72	72	48	48	763
13	358	313	4207	90	5,057
14	156	156	52	104	19,016
15	123	82	41	41	2,248
16	642	856	143	571	13,845
17	178	178	89	400	4,885
18	264	113	23	23	970
19	90	53	18	18	801
20	36	202	101	202	4,945
21	237	473	118	118	9,588
22	706	532	355	177	194,585
Total	8272	7135	7689	4278	350,195

Chromium

Daily average chromium loads of 4278 gm/day were observed. Outfall TC 40, in section 2, accounted for 23% of the total load. This outfall was sampled at a manhole on Dundas St., west of River St. and drains an area that is, for the most part, residential. Chromium results for this outfall exceeded modified bylaw limits on 2 of 6 samples.

Outfall ND 1479, located in the proximity of an industrial area west of Don Mills Rd, exceeded the chromium limits in 4 of 6 samples. This outfall discharged an average load of 192 gm/day of chromium.

Effluent from the North Toronto WPCP accounted for 8% of the daily load of chromium.

Iron

A daily iron loading of 350,195 gm/day was observed. Based upon the screening run data, outfall RG 944, in section 22, accounted for 53% of the total load of iron. The outfall was not intensively sampled because of delays in obtaining analytical results. Outfall RG 944 did not violate bylaw limits on either occasion that it was sampled for metals. Outfalls NN 1544, NC 1438 and SC 415 violated modified bylaw limits 5 out of 5 times, 3 out of 5 times and 4 out of 4 times, respectively, and accounted for 3%, 2% and 2% of the total iron loads, respectively. Iron loads from the North Toronto WPCP were 4% of the total load.

5.8 Classification of Outfalls

5.8.1 Exceedence of Modified Bylaw Limits

The number of outfalls which on any occasion exceeded modified bylaw limits are summarized in Table 18. Comparisons between municipalities should be made based on the percentage of the total outfalls within each jurisdiction. The totals for each parameter are not additive since one outfall may exceed more than one water quality criteria.

Fecal coliform densities were the most frequently encountered violation, with approximately 16% of outfalls sampled being in excess of criteria. Other commonly observed water quality problems at sampled outfalls were suspended solids (31%) and iron (25%). Relatively few outfalls were

TABLE 18. SUMMARY OF THE NUMBER OF OUTFALLS EXCEEDING MODIFIED BYLAW LIMITS FOR EACH PARAMETER BY MUNICIPALITY

PARAMETER	EAST YORK	MARKHAM	NORTH YORK	RICHMOND HILL	SCARBOROUGH	TORONTO	VAUGHAN	TOTAL
Fecal Coliform (1)	15	3	40	6	23	8	2	97
BOD	9	1	26	2	21	9	0	68
Suspended Solids	20	17	74	13	27	19	10	180
Total Phosphorus	7	4	31	3	18	10	2	75
TKN	1	1	6	0	5	2	0	15
Zinc	0	1	5	1	4	1	0	12
Lead	1	1	4	0	2	1	0	9
Copper	1	1	2	0	2	1	0	7
Chromium	1	1	3	0	3	1	0	9
Iron	20	7	58	16	20	16	7	144
Phenol	3	2	6	1	3	1	0	16
pH	0	0	0	1	2	0	0	3

Note: (1) Based on loading criteria, rather than concentration value

observed to exceed the metal parameters of zinc (12), lead (9), copper (7) and chromium (9).

Only three outfalls violated pH criteria. Outfall RE 618 in section 21 had a pH >12 on 3 of 6 occasions. The origin of the high pH effluent appeared to be a nearby concrete block manufacturer. A follow-up investigation will be necessary to confirm the source of this discharge.

The remaining two outfalls, SC 421 and SC 484, each violated pH criteria on 1 of 6 occasions and 1 of 2 occasions, respectively.

5.8.2 Group A Outfalls

A summary of the Group A outfalls in each municipality and the number of modified bylaw violations for each parameter is provided in Table 19. An additional method of ranking outfalls of concern is provided in Appendix VI. Outfalls are ranked by the number of times each parameter was above the modified bylaw limit and by the average load from that outfall. Rankings for fecal coliform violations were based solely upon loadings.

In total, 148 outfalls or 25% of all outfalls sampled were identified as Group A priority outfalls. North York had the largest number of Group A outfalls with 71 or 43% of the total.

5.8.3 Group B Outfalls

Group B outfalls are summarized in Table 20 in a fashion similar to the Group A outfalls.

Outfalls are also ranked by the number of violations of bylaw limits and the load average for each parameter by municipality for each Group B outfall in Appendix VI.

TABLE 19. NUMBER OF OCCASIONS PARAMETERS VIOLATED MODIFIED BYLAW LIMITS FOR GROUP A OUTFALLS

OUTFALL NUMBER	FC	BOD	SS	TP	TKN	Zn	Pb	Cu	Cr	Fe	PHENOLS	pH
EAST YORK GROUP A OUTFALLS												
EA 207	X		3	2	0							
208	X					0		0	0	3		
ED 245	X											
241	X											
EF 1904	X											
254	X											
EG 261			3	0	1							
270	X		4	5	0							
283						0		0	0	5		
284						0		0	1	0		
1907	X											
291	X											
275	X											
286	X											
292												
EH 162	X		4	1	0	0		0	0	4	2	
176	X										1	
182	X											
EK 222	X		0	1	0	0		0	0	1		
229												
232			1	4								

Note: All parameters sampled intensively are listed. Parameters left blank were not sampled intensively.

The letter X in the FC column indicates violation of modified bylaw limits based upon the average of at least four occasions.

TABLE 19 (CONT'D). NUMBER OF OCCASIONS PARAMETERS VIOLATED MODIFIED BYLAW LIMITS FOR GROUP A OUTFALLS

OUTFALL NUMBER	FC	BOD	SS	TP	TKN	Zn	Pb	Cu	Cr	Fe	PHENOLS	pH
MARKHAM GROUP A OUTFALLS												
MD 814	X											
820	X	2	2	1								
831	X											
ME 845						0	1	0	0	0		
NORTH YORK GROUP A OUTFALLS												
NB 1415	X											
1416	X											
1418	X					0	0	0	0	1		
NC 1438		1	6	6	0	1	1	0	0	3	2	
1439		2	6	6	0	1	1	0	0	2	2	
1443	X	1	2	0								
1453	X											
1455	X											
1463	X	2	0	0								
ND 501	X					0	0	0	0	4		
503	X	2	1	1		0	0	0	0	1		
504	X											
1467			2		0	0	0	0	0	1		
1472	X	1	1	1								
1479						1	0	0	4	0		
1480	X	1	1	1								
NF 513	X					0	0	0	1	0		
514	X											
515		1	3	0								
518	X											
523					1							
524	X											
NG 539		2	2	3		0	0	0	0	1		
681		0	5	0	0	0	0	0	0	2		
NH 556		5	5	3								
NI 808	X											
981		0	0	1								
NJ 1613	X											
1614	X											
1618	X											

Note: All parameters sampled intensively are listed. Parameters left blank were not sampled intensively.

The letter X in the FC column indicates violation of modified bylaw limits based upon the average of at least four occasions.

TABLE 19 (CONT'D). NUMBER OF OCCASIONS PARAMETERS VIOLATED MODIFIED BYLAW LIMITS FOR GROUP A OUTFALLS

OUTFALL NUMBER	FC	BOD	SS	TP	TKN	Zn	Pb	Cu	Cr	Fe	PHENOLS	pH
NORTH YORK GROUP A OUTFALLS (cont'd)												
NK 1626	X											
1636	X											
1641	X											
1643	X											
1644	X											
NM 1502		0	1	0								
1505	X											
NN 1544	X	2	5	2			0	0	0	5		
1545	X	0	1	0			0	0	0	4		
NP 1101	X	1	0	0								
1115	X	0	0	1								
NQ 1150							0	1	0	0		
1151	X											
NR 1163		1	5	2	1							
1164		2	4	3	0							
1254	X											
1255		0	2	1		0	0	0	0	3		
1257	X											
NT 1171	X											
1173	X		0	2	0							
NU 528		2	2	3	1							
531	X	0	0	1								
534		1	1	0								
673	X											
NV 1564		0	3	0								
1570		6	5	0								
NX 1401		3	3	1								
1403						0	0	0	1	0		
1407	X											
1410		1	1	0								
NY 563	X	0	2	0								
701		1	1	3								
702	X											

Note: All parameters sampled intensively are listed. Parameters left blank were not sampled intensively.

The letter X in the FC column indicates violation of modified bylaw limits based upon the average of at least four occasions.

TABLE 19 (CONT'D). NUMBER OF OCCASIONS PARAMETERS VIOLATED MODIFIED BYLAW LIMITS FOR GROUP A OUTFALLS

OUTFALL NUMBER	FC	BOD	SS	TP	TKN	Zn	Pb	Cu	Cr	Fe	PHENOLS	pH
RICHMOND HILL GROUP A OUTFALLS												
RB 882	X											
RC 892	X											
1040	X											
RD 612		2	2	0							1	
613	X											
RE 618		1	5	0								3
RF 638	X											
639		0	2	1		0	0	0	0	1		
642	X											
RG 915						1	0	0	0	0		
944		0	3	1								
RH 899		0	6	6		0	0	0	0	5		
SCARBOROUGH GROUP A OUTFALLS												
SA 330				1								
337		3	5	0								
339	X											
SB 348	X	1	2	0								
349	X	3	5	3								
351		2	1	3	1							
365	X											
366	X	2	2	1								
368						4	0	0	0	0		
373	X											
378	X											
387	X											
390	X											
SC 399										4		
404	X	3	4	3			1	1		5		
415		1	3	0		0	0	0	0	4		
421	X	5	3	3								1
469	X											
472	X	5	5	5	3	4	2	0	0	4		
475						0	0	0	0	5		
485		3	5	4	1	2	0	1	1	3		
489	X	1	1	1	0	0	0	0	0	1		

Note: All parameters sampled intensively are listed. Parameters left blank were not sampled intensively.

The letter X in the FC column indicates violation of modified bylaw limits based upon the average of at least four occasions.

TABLE 19 (CONT'D). NUMBER OF OCCASIONS PARAMETERS VIOLATED MODIFIED BYLAW LIMITS FOR GROUP A OUTFALLS

OUTFALL NUMBER	FC	BOD	SS	TP	TKN	Zn	Pb	Cu	Cr	Fe	PHENOLS	pH
SCARBOROUGH GROUP A OUTFALLS (cont'd)												
SC 1800	X	3	3	1	0	0	0	0	0	1		
1804		2	4	0	0							
SD 425	X					0	0	0	1	0		
426	X											
427	X											
435	X											
438	X	2	3	3								
439	X	1	2	1	1							
SE 444	X	1	1	0								
448		2	2	1								
449	X	0	0	2								
TORONTO GROUP A OUTFALLS												
TA 1	X	2	6	1								
TB 19		1	4	1		1	1	1	0	5		
20		5	5	2								
27	X	6	6	6	6						4	
28	X	2	2	1								
35	X											
36		5	5	4	4							
TC 40	X					0	0	0	2	0		
43	X	1	0	0								
47	X	1	2	0								
51		1	2	3								
TF 66	X											
VAUGHAN GROUP A OUTFALLS												
VA 1197	X					0	0	0	0	1		
VD 1208		0	1	1								
VG 1232	X											

Note: All parameters sampled intensively are listed. Parameters left blank were not sampled intensively.

The letter X in the FC column indicates violation of modified bylaw limits based upon the average of at least four occasions.

TABLE 20. NUMBER OF OCCASIONS PARAMETERS VIOLATED MODIFIED BYLAW LIMITS FOR GROUP B OUTFALLS

OUTFALL NUMBER	FC	BOD	SS	TP	TKN	Zn	Pb	Cu	Cr	Fe	PHENOLS	pH
EAST YORK GROUP B OUTFALLS												
EA 205										1		
207*		1										
208*			1									
210			1							1		
212			1									
EF 250		1	1				1			1		
259			1							1		
249												
EG 287	X											
1920	X											
290										2		
299										1		
1917										1		
261*	X	1								1	1	
270*	X	1										
278		2	2	2								
281			2									
282			1									
283*			1	1								
264										1		
269										2		
297	X											
EH 162*		3										
166	X		1	1						1		
171			2							2		
176*		1	2									
182*		1										
158			2							2		
164										1		
1912										1		
153												
155												
175	X											
EI 196			1									
EK 222*		1										
232*								1		2		
237			1									
EL 188										2		

Note: * Indicates outfalls which also appear in Group A list.

The letter X in the FC column indicates violation of modified bylaw limits based upon the average of at least four occasions.

TABLE 20 (CONT'D). NUMBER OF OCCASIONS PARAMETERS VOLATILE MODIFIED BYLAW LIMITS FOR GROUP B OUTFALLS

OUTFALL NUMBER	FC	BOD	SS	TP	TKN	Zn	Pb	Cu	Cr	Fe	PHENOLS	pH
MARKHAM GROUP B OUTFALLS												
MA 586	X											
585	X											
711	X											
565										1		
567			2							2		
568			1							1		
570	X		1									
574										1		
583			1							1		
584			1							1		
706			1									
816			1									
MB 589			1									
MD 814			1									
818				1								
825			1	1								
839			1									
ME 845*			1								1	
851			1									
853				1	1	2	0	1	2	0		
946			1							2	1	
956			2									
992			1									
977	X											
850	X											
NORTH YORK GROUP B OUTFALLS												
NB 1417			1							1		
1422			1									
1426										1		
1590			1							1		
NC 1438*											1	
1439*	X											
1446			1									
1455												
1457			1									

Note: * Indicates outfalls which also appear in Group A list.

The letter X in the FC column indicates violation of modified bylaw limits based upon the average of at least four occasions.

TABLE 20 (CONT'D). NUMBER OF OCCASIONS PARAMETERS VIOLATED MODIFIED BYLAW LIMITS FOR GROUP B OUTFALLS

OUTFALL NUMBER	FC	BOD	SS	TP	TKN	Zn	Pb	Cu	Cr	Fe	PHENOLS	pH
NORTH YORK GROUP B OUTFALLS (cont'd)												
1459										2		
1460	X			1								
1461										1		
1464			2							2		
1465	X											
1466			1							1		
ND 501*			1									
503*											1	
1468										2		
1469	X											
1486			1									
1487			1									
1493	X											
1494	X											
NE 506			1									
510			1							1		
512			1							1		
NF 513*			2	1								
515*										1		
518*										1		
519										1		
523*												
NG 545	X											
539*												
543	X											
546	X									1		
652			1									
653										2		
661			1									
666			1							1		
679			1							1		
680			1							1		
NH 551	X	1	1	1								
552			1									
556*										1		
686										1		
687			1									
550		2	2	1								

Note: * Indicates outfalls which also appear in Group A list.

The letter X in the FC column indicates violation of modified bylaw limits based upon the average of at least four occasions.

TABLE 20 (CONT'D). NUMBER OF OCCASIONS PARAMETERS VIOLATED MODIFIED BYLAW LIMITS FOR GROUP B OUTFALLS

OUTFALL NUMBER	FC	BOD	SS	TP	TKN	Zn	Pb	Cu	Cr	Fe	PHENOLS	pH
NORTH YORK GROUP B OUTFALLS (cont'd)												
NI 803										1		
806	X											
801	X											
983			1							1		
NJ 1612										1		
1613*			1									
1614*			1									
1604	X		1									
NK 1623	X											
1622	X											
1636*			1									
1638				1								
NM 1496			1									
1500			1									
1502*	X									1		
1504										1		
1506										2		
1507			1									
1701										1		
NN 1293	X	1	1	1	1							
1509										2		
1511			1									
1512	X		1									
1516	X			1								
1523*		2	1	2							1	
1528										1		
1533				1						2		
1703										1		
NO 1548			1									
1549	X											
1553										1		
NP 1109	X											
1240	X											
NQ 1141										2		
1142										1		
1145										1		
1146			1									
1147	X		1									
1151*			1							1		

Note: * Indicates outfalls which also appear in Group A list.

The letter X in the FC column indicates violation of modified bylaw limits based upon the average of at least four occasions.

TABLE 20 (CONT'D). NUMBER OF OCCASIONS PARAMETERS VIOLATED MODIFIED BYLAW LIMITS FOR GROUP B OUTFALLS

OUTFALL NUMBER	FC	BOD	SS	TP	TKN	Zn	Pb	Cu	Cr	Fe	PHENOLS	pH
NORTH YORK GROUP B OUTFALLS (cont'd)												
NR 1162		1	1	1	1	1	1	0	0	1	1	
1255	X											
1156	X		1	1								
1164	X											
1163*										1		
1165										1		
1249	X											
1254*			1					1				
1256	X				1							
NS 1182			1									
NT 1166										1		
1170	X											
1172										2		
NU 530*			2							1		
534*	X											
669			1							1		
NV 1566	X		1									
1495	X											
NW 1129			2									
1132	X											
NX 1401*										2		
1410	X											
1405	X			1								
1409			1							1		
1404	X									1		
NY 5634												
RICHMOND HILL GROUP B OUTFALLS												
RC 890	X											
896			1							1		
910	X											
RD 613*			1							1		
599	X											
RE 618*										1		
627										1		
632										1		
636										1		
638										1		

Note: * Indicates outfalls which also appear in Group A list.

The letter X in the FC column indicates violation of modified bylaw limits based upon the average of at least four occasions.

TABLE 20 (CONT'D). NUMBER OF OCCASIONS PARAMETERS VIOLATED MODIFIED BYLAW LIMITS FOR GROUP B OUTFALLS

OUTFALL NUMBER	FC	BOD	SS	TP	TKN	Zn	Pb	Cu	Cr	Fe	PHENOLS	pH
RICHMOND HILL GROUP B OUTFALLS (cont'd)												
RF 637										1		
641			1							2		
642*			1									
644			1							1		
RG 915*			1									
927										1		
934			1							1		
936			1									
939										1		
944	X									1		
SCARBOROUGH GROUP B OUTFALLS												
SA 314										1		
335	X											
333			1									
337*	X											
338	X											
SB 349*										2		
353			1							1		
368*		1										
373*			1									
375	X											
346	X											
393	X											
SC 396*	X									1		
399			1									
403										1		
406*	X	1	1									
415*												
458			1							2		
464										2		
470	X			1								
472*											2	
475*			1									
477	X											
478	X											
485*											1	
1804*										2		
484			2	1								
497		1	1	1	0	1	0	0	1	1		1

Note: * Indicates outfalls which also appear in Group A list.

The letter X in the FC column indicates violation of modified bylaw limits based upon the average of at least four occasions.

TABLE 20 (CONT'D). NUMBER OF OCCASIONS PARAMETERS VIOLATED MODIFIED BYLAW LIMITS FOR GROUP B OUTFALLS

OUTFALL NUMBER	FC	BOD	SS	TP	TKN	Zn	Pb	Cu	Cr	Fe	PHENOLS	pH
SCARBOROUGH GROUP B OUTFALLS (cont'd)												
SD 429	X	2	2	2								
438*					1					1		
439*										1	1	
SE 451	X									1		
TORONTO GROUP B OUTFALLS												
TA 1*										2		
TB 22			2							2		
27*										2		
28*										1		
31			1									
34	X											
19	X											
36*										1		
TC 49	X		1	1						2		
50	X									1		
51*	X											
53	X											
93			1							1		
TE 78										1		
79			1									
TF 57										2		
59	X											
80			1							1		
83			1	1								
64	X											
85										1		
88			1							1		
TG 71	X											
TH 131	X		1	1						1		
132	X		1							1		
TI 69			1									
VAUGHAN GROUP B OUTFALLS												
VA 1187	X											
1190			1									
1192	X											
1202	X											

<u>Note</u>: * Indicates outfalls which also appear in Group A list.

The letter X in the FC column indicates violation of modified bylaw limits based upon the average of at least four occasions.

TABLE 20 (CONT'D). NUMBER OF OCCASIONS PARAMETERS VIOLATED MODIFIED BYLAW LIMITS FOR GROUP B OUTFALLS

OUTFALL NUMBER	FC	BOD	SS	TP	TKN	Zn	Pb	Cu	Cr	Fe	PHENOLS	pH
VAUGHAN GROUP B OUTFALLS (cont'd)												
VD 1208*										1		
1214	X			1								
VF 1236			1									
VG 1233	X											
VH 858	X		1							1		
863	X		1									
869			1									
870										1		
VM 1302			1							2		
1303	X											
1311			1							1		
1314			1							1		

Note: * Indicates outfalls which also appear in Group A list.

The letter X in the FC column indicates violation of modified bylaw limits based upon the average of at least four occasions.

5.8.4 Outfalls with Unknown Effluent Characteristics

A number of outfalls (39) were not sampled because they were submerged in river water. An attempt should be made to sample these outfalls at the first uncontaminated manhole upstream from the river. In addition, 20 outfalls in Reaches TA, TB and TC were not surveyed due to access problems. Some attempt should be made to evaluate their characteristics where possible.

6.0 SUMMARY

During the late summer and fall of 1984, a dry weather outfall survey was conducted on the Don River and its tributaries. A total of 1423 outfalls were inventoried. Of the 1423 outfalls surveyed, 687 or 49% were actively flowing. The remaining outfalls were either dry (677), submerged (39) or not surveyed (20). A total of 594 or 86% of the active outfalls were sampled for various water quality parameters (the remainder had flows too low to sample or were inaccessible). Based on analytical results from the screening surveys, a number of outfalls were deemed to discharge potentially excessive concentrations of pollutants (above screening criteria) and were intensively sampled on up to 4 more occasions.

Outfalls were categorized as to the degree of contamination of the effluent and were presented in such a manner as to allow prioritization of problem areas. Outfalls of concern (those which violated modified bylaw parameters) were categorized as Group A where sufficient information was available ($\geq$ four samples) or as Group B where additional outfall sampling was needed ($\leq$ four samples). Outfalls within each group were ranked by parameter as to the number of bylaw violations and the average outfall load. Fecal coliform violations were ranked only by loading.

A total dry weather discharge of 1.65 m^3/sec was measured flowing into the Don River. The North Toronto Water Pollution Control Plant (WPCP) accounted for 24% of the total discharge to the river.

Reported average concentrations of parameters at the North Toronto WPCP (average over study period obtained from the plant) were higher than those measured from outfalls for all parameters but fecal coliform (34 org/100 mL) and chromium (<.01 mg/L).

Fecal coliform densities exceeded guidelines limits at approximately 16% of all sampled outfalls. Other frequently observed modified bylaw violations at sampled outfalls were suspended solids (31%) and iron (25%). Few heavy metal problems were observed at outfalls.

Substantial loads of all of the pollutants measured for were observed entering the river. Some sections and outfalls were found to contribute major portions of the total load. The following summarizes major findings:

- North Toronto WPCP was a major contributor to the load of several parameters, including BOD (31%), lead (19%), copper (7%), chromium (15%) and iron (4%).

- Outfalls in the lower reaches of the Don River accounted for high proportions of the total input of several pollutants.
  TB 20 fecal coliform (5%), BOD (6%)
  TB 27 fecal coliform (3%), BOD (5%), TKN (4%), phenolic (4%)
  TB 40 fecal coliform (1%), lead (3%), chromium (23%)
  TB 47 fecal coliform (8%), BOD (1%)
  TB 36 fecal coliform (1%)

- Some outfalls discharging into Massey Creek were found to have high pollutant loads for example:
  SC 421 BOD (2%)
  SB 368 zinc (8%)
  SC 472 BOD (2%)
  SC 1800 BOD (1%)

- Suspended solids loads were high in areas associated with construction, for example: RG 944 (36% of total input) and on Burke's Brooke (TH 131, 14% of total). Outfall RG 944 was also responsible for the following amounts of the total load: 10% of the TKN, 11% of the zinc and 53% of iron.

- Outfall NR 1164 accounted for 79% of the total phosphorus input into the river.

- Outfall EH 162 accounted for 38% of the total phenolic load into the river.

- On one occasion, Outfall NR 1254 had a high copper concentration which amounted to 63% of the total average copper load.

A total of 148 Group A Outfalls were identified. In addition, 269 outfalls were categorized in Group B.

The following are recommendations for follow-up to this survey:

(i) Outfalls in Group A which are consistent contributors of pollutants, and are therefore of high priority, should be investigated to locate the source of contaminants.

(ii) Outfalls in Group B which are listed as high priority should have additional sampling conducted at the outfall to assess the extent of the problem.

(iii) Remaining submerged outfalls should be investigated at the first upstream manhole to assess the effluent quality of these outfalls.

7.0 REFERENCES

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Information Builders Inc., 1984. PC/FOCUS Users Manual Release 1.0 Information Builders Inc., New York.

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Provincial-Municipal Affairs Secretariat, 1984. 1984 Municipal Directory. Ontario Ministry of Municipal Affairs and Housing, Queen's Printers, Ontario, p. 244.

8.0 ACKNOWLEDGEMENTS

CANVIRO Consultants Ltd. would like to gratefully acknowledge the following agencies and personnel who participated in this survey.

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- Laboratory technicians and support staff at the Ministry of the Environment, Rexdale, IEC Beak and R. Young and Associates.
- Municipal and City Engineering Departments.
- Ministry of the Environment Water Resources Branch.
- Members of the TAWMS Study Group.

This study was funded under the Toronto Area Watershed Management Study.

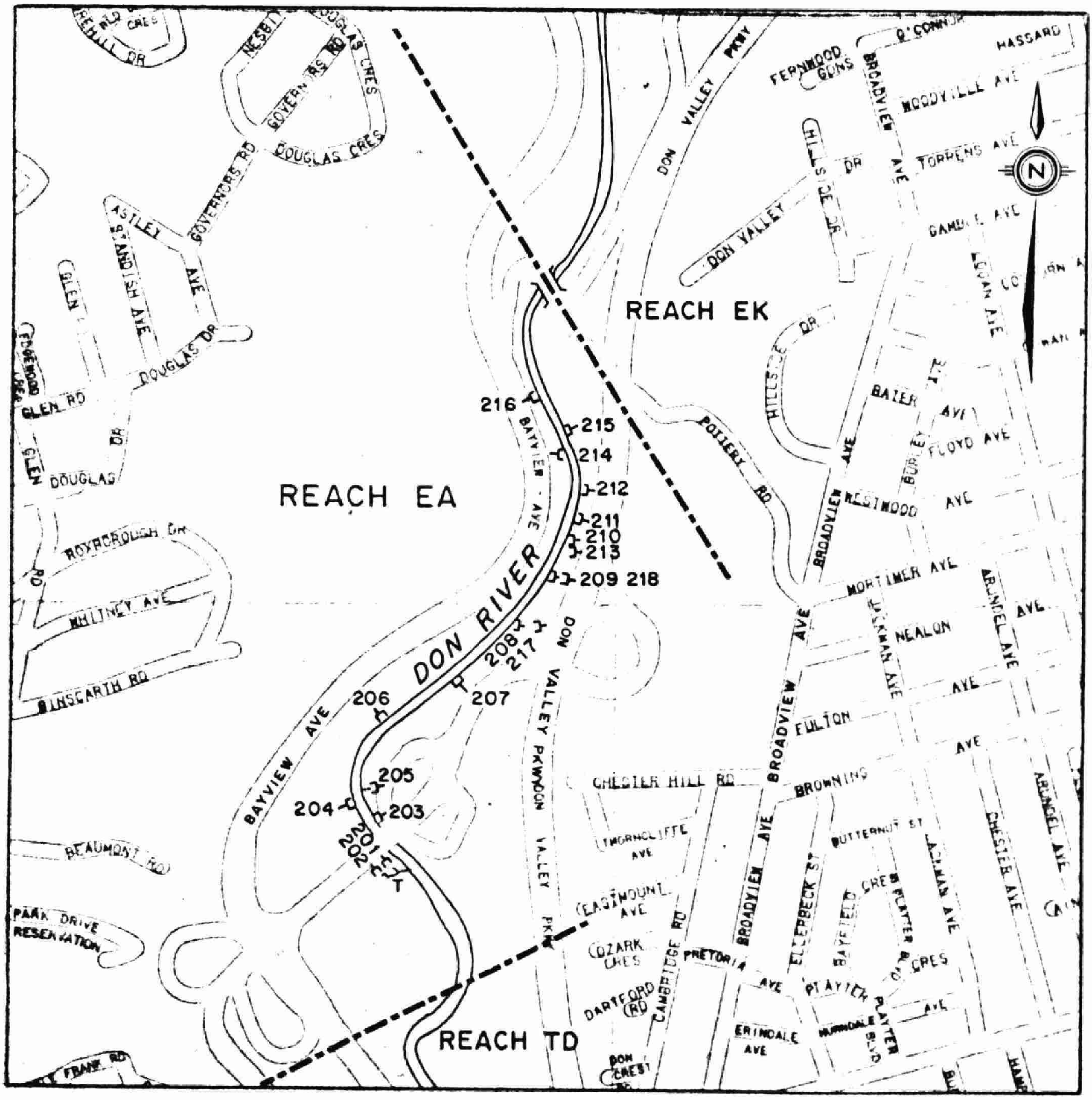
APPENDIX I

DON RIVER REACH MAPS

REACH MAPS (LISTED ALPHABETICALLY)

FIGURE	REACH	FIGURE	REACH	FIGURE	REACH
I-1	EA	I-31	NK1	I-61	SB1
I-2	ED	I-32	NK2	I-62	SB2
I-3	EE	I-33	NM	I-63	SC1
I-4	EF	I-34	NN1	I-64	SC2
I-5	EG1	I-35	NN2	I-65	SD
I-6	EG2	I-36	NO	I-66	SE
I-7	EH1	I-37	NP	I-67	TA
I-8	EH2	I-38	NQ	I-68	TB
I-9	EI	I-39	NR1	I-69	TC
I-10	EJ	I-40	NR2	I-70	TD
I-11	EK	I-41	NS	I-71	TE
I-12	EL	I-42	NT	I-72	TF
I-13	MA1	I-43	NU1	I-73	TG
I-14	MA2	I-44	NU2	I-74	TH
I-15	MB1	I-45	NV	I-75	TI
I-16	MB2	I-46	NW	I-76	VA1
I-17	MD1	I-47	NX	I-77	VA2
I-18	MD2	I-48	NY	I-78	VB
I-19	ME	I-49	RA	I-79	VD
I-20	NB	I-50	RB	I-80	VE
I-21	NC1	I-51	RC1	I-81	VF
I-22	NC2	I-52	RC2	I-82	VG
I-23	ND	I-53	RD1	I-83	VH
I-24	NE	I-54	RD2	I-84	VJ
I-25	NF	I-55	RE1	I-85	VK1
I-26	NG1	I-56	RE2	I-86	VK2
I-27	NG2	I-57	RF	I-87	VM1
I-28	NG	I-58	RG1	I-88	VM2
I-29	NI	I-59	RG2	I-89	VP
I-30	NJ	I-60	SA		

REACH EA



L E G E N D

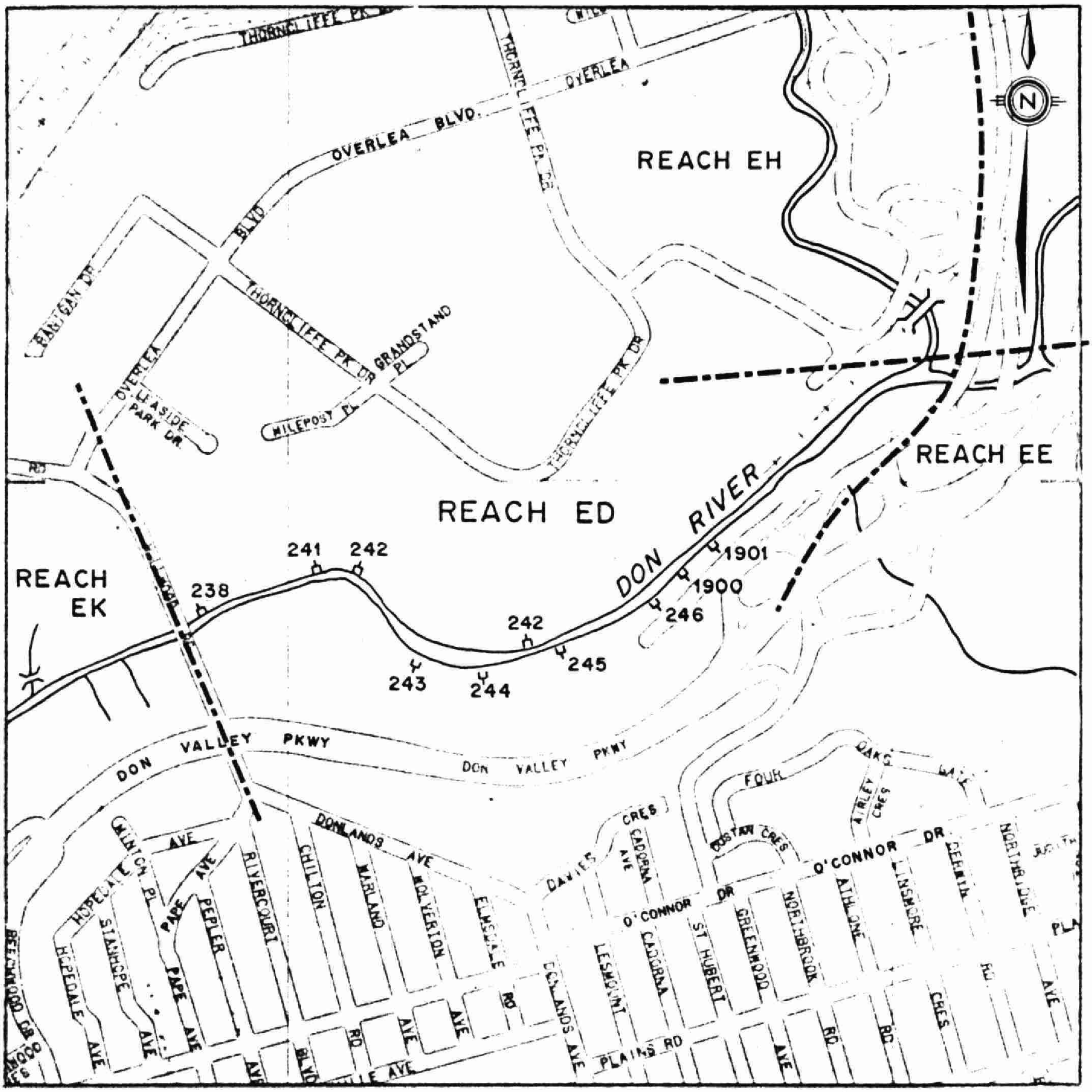
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-1. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH ED



LEGEND

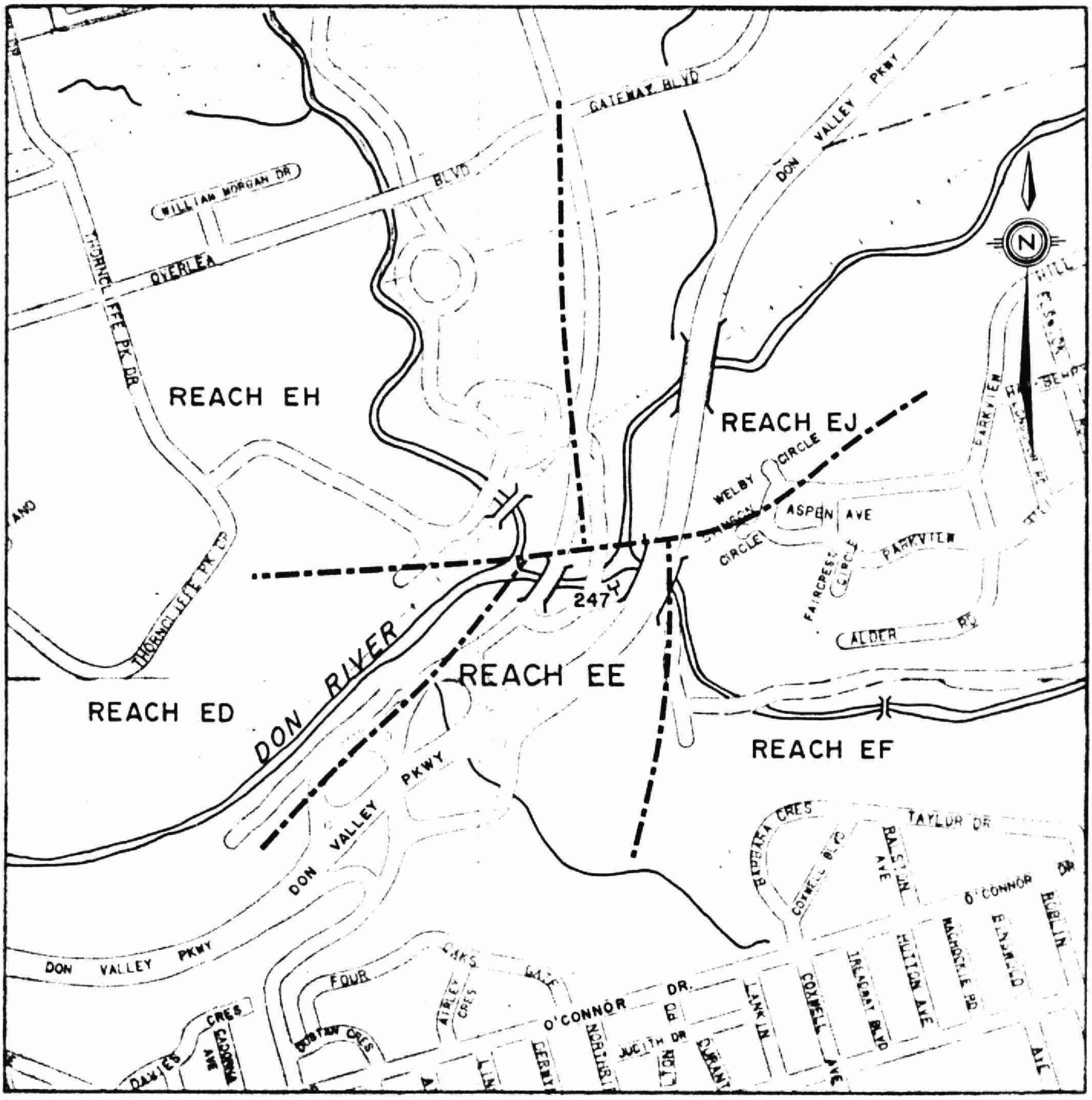
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-2. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH EE



LEGEND

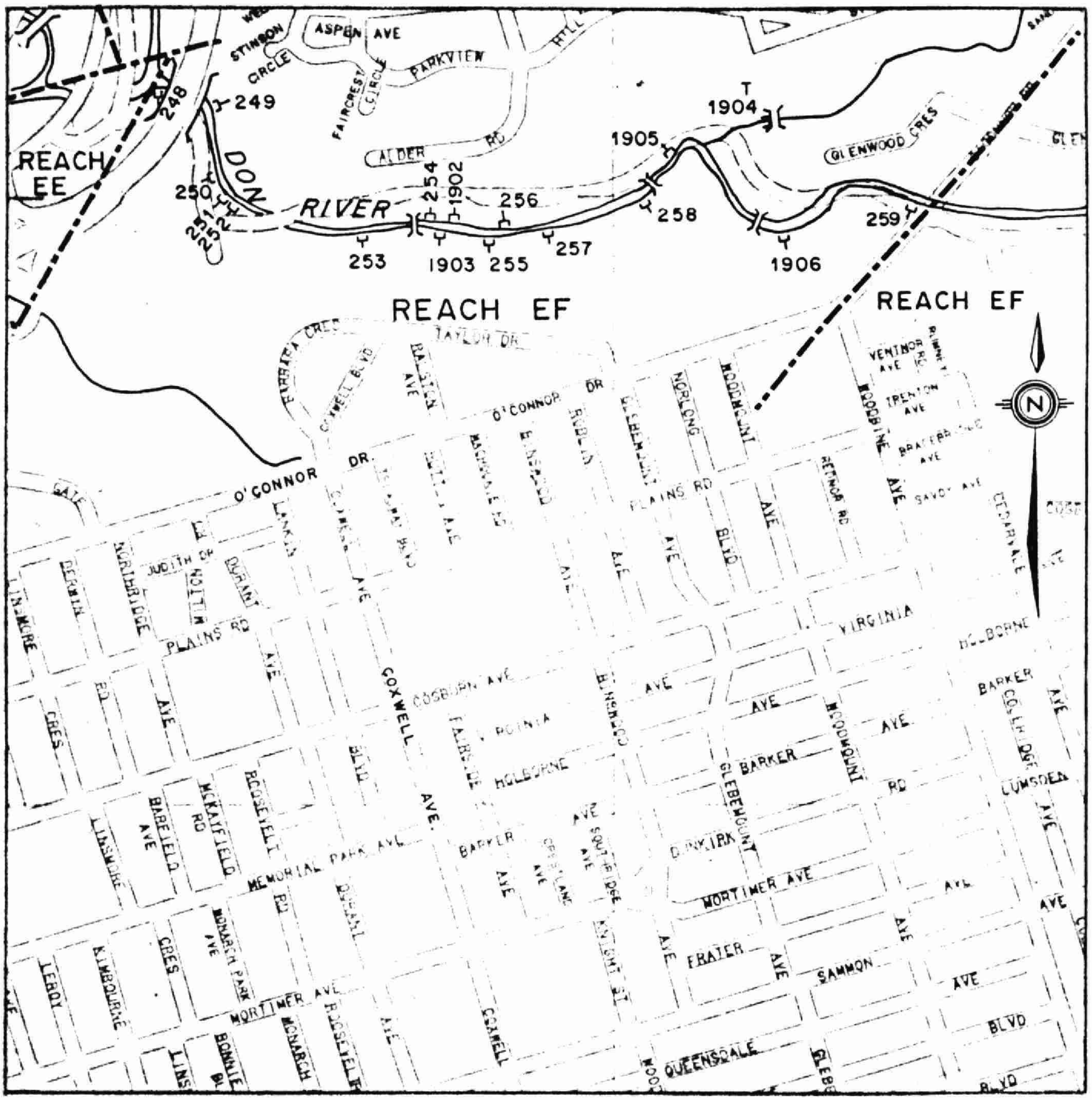
⊐— 804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-3. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH EF



L E G E N D

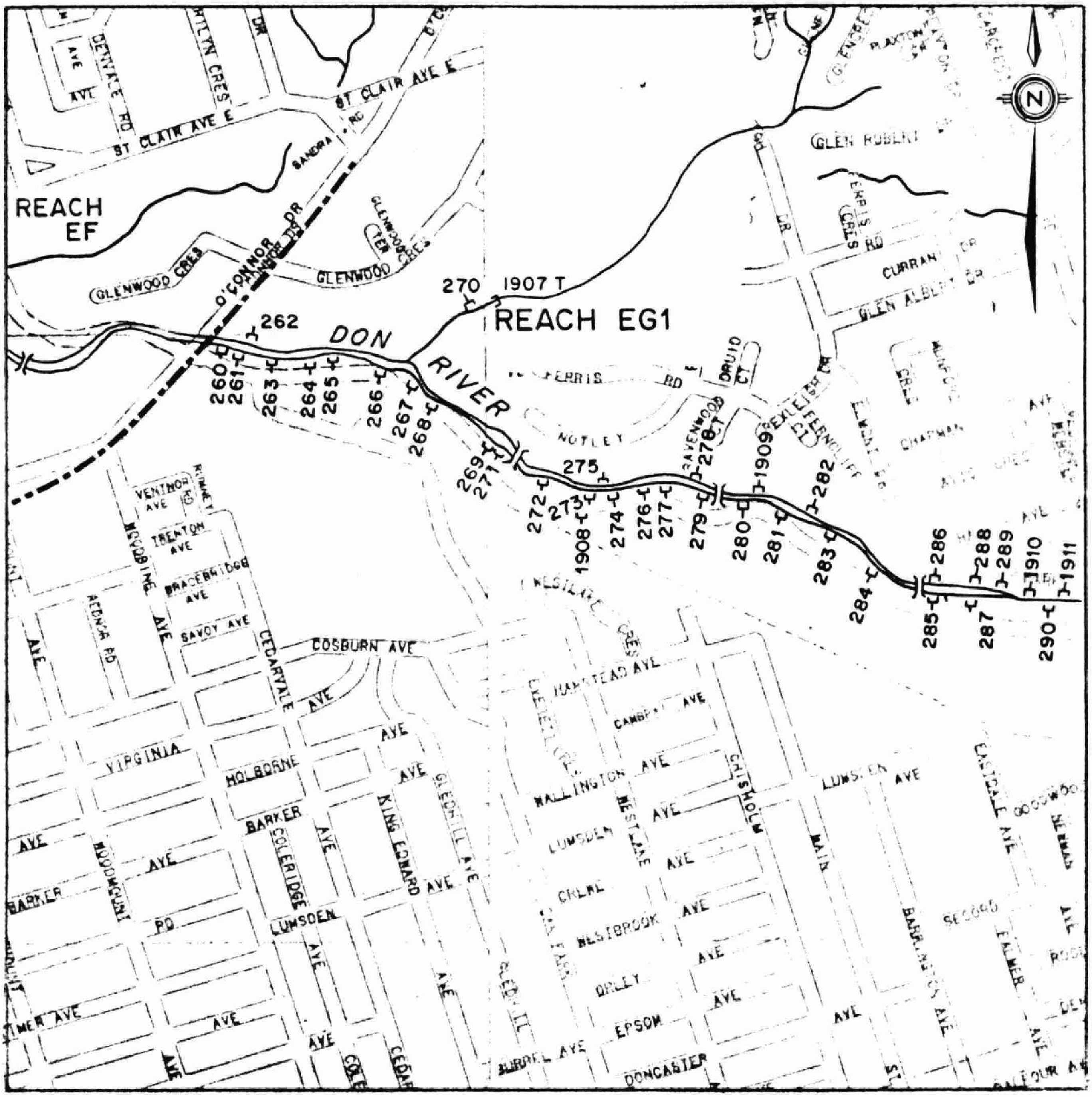
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-4. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH EG1



LEGEND

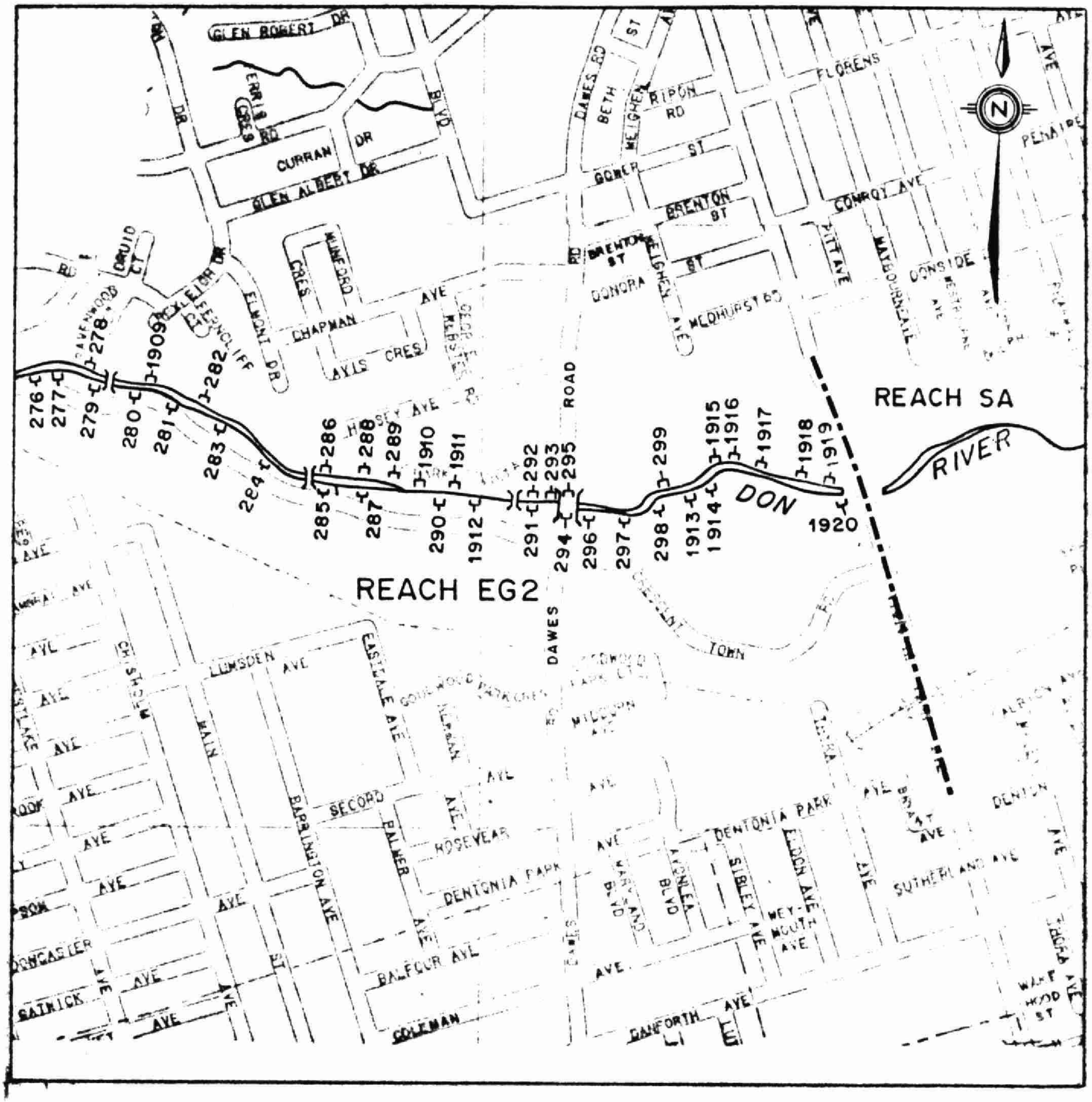
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD.

FIGURE I-5. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH EG2



LEGEND

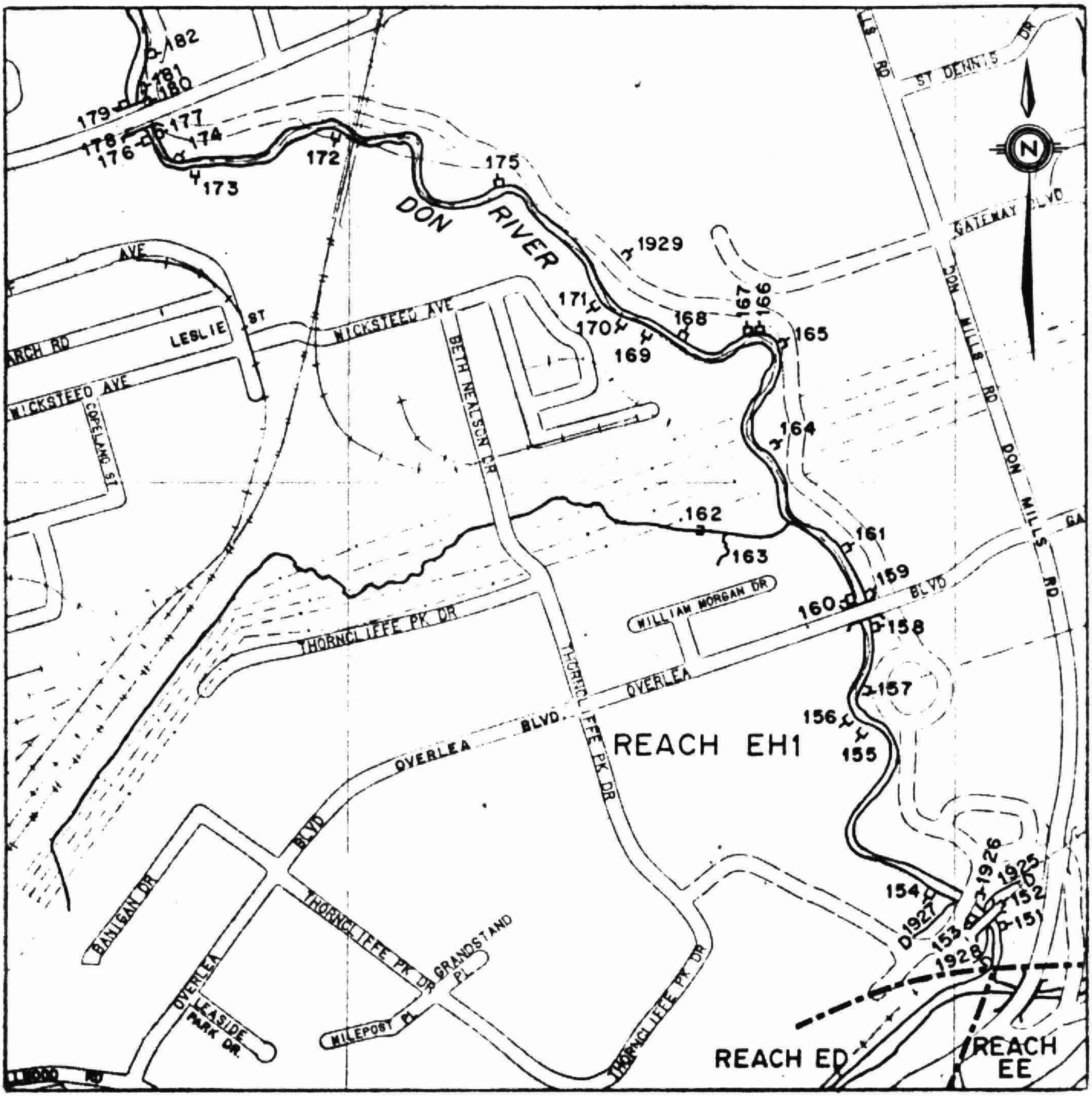
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD.

FIGURE I-6. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH EH1



LEGEND

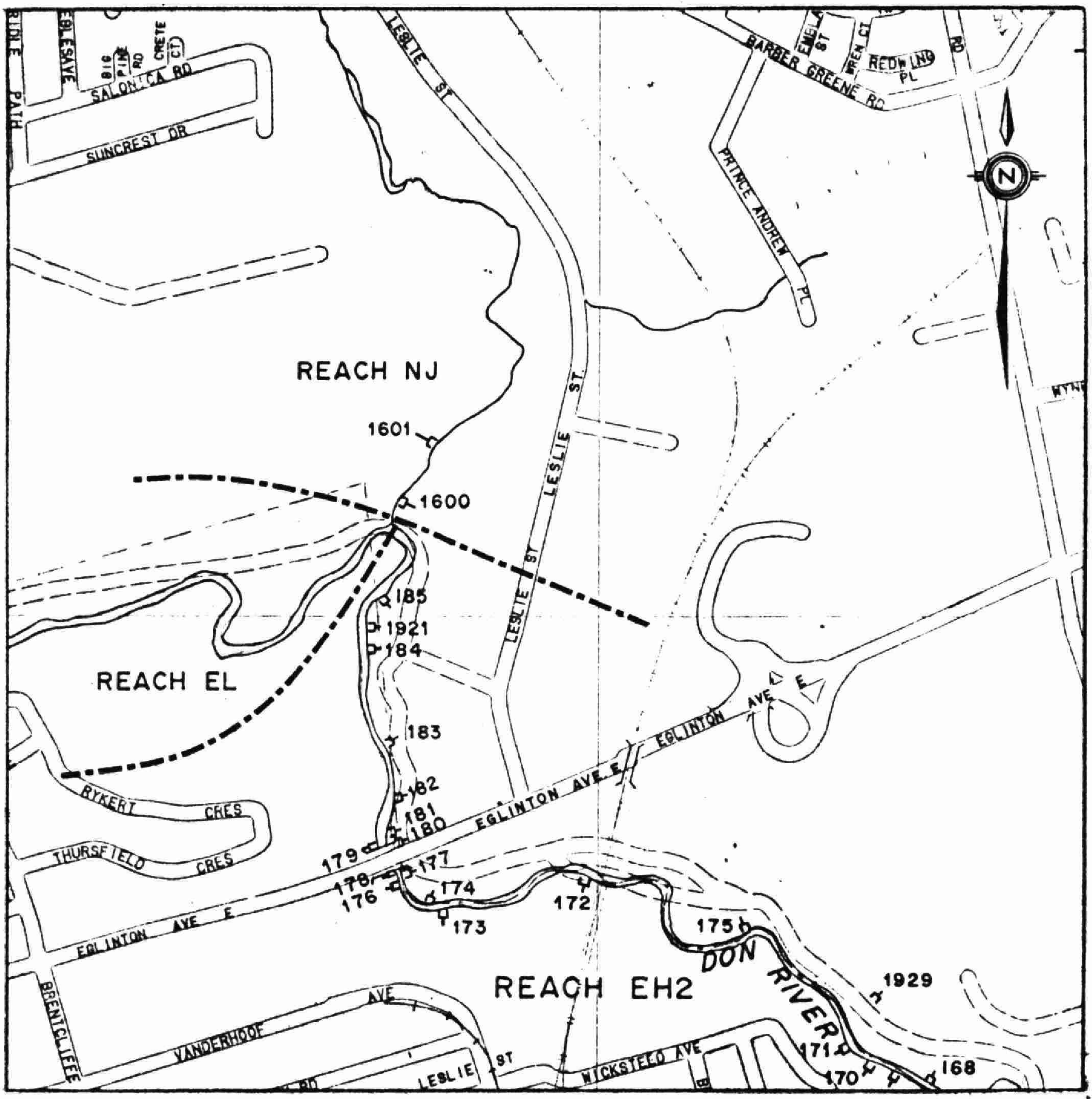
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-7. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH EH2



LEGEND

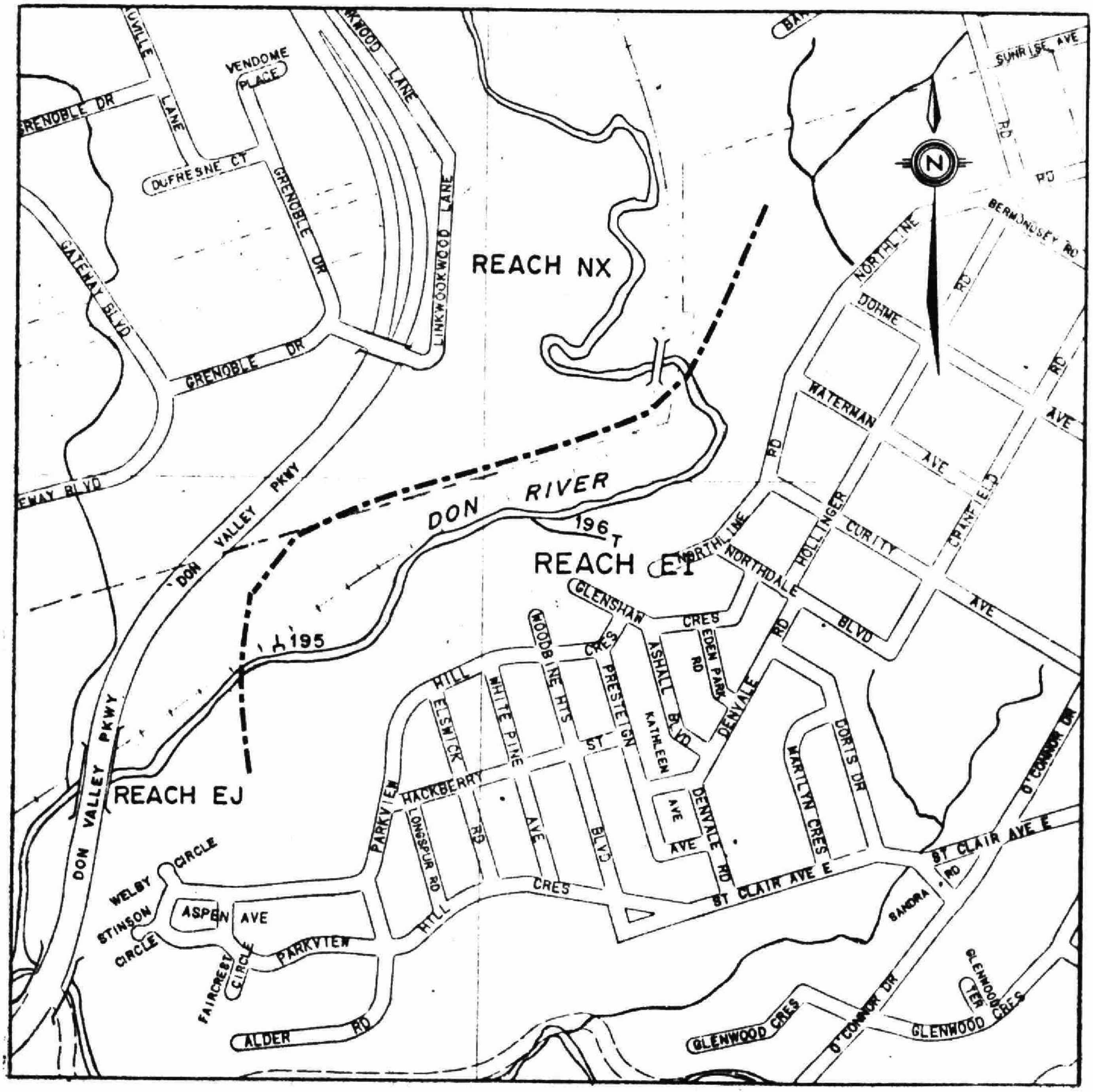
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-8. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH EI



LEGEND

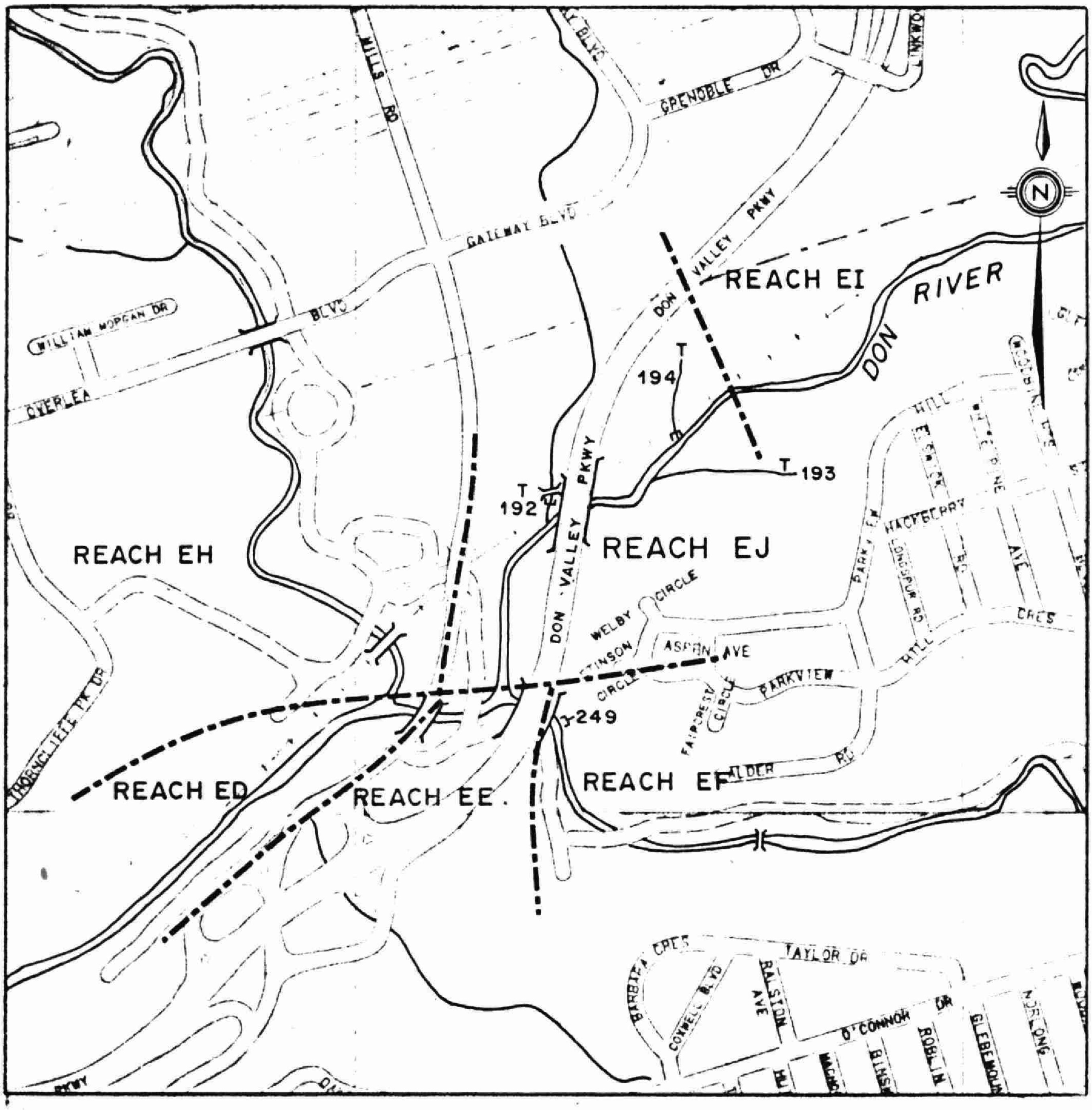
- 804 OUTFALL LOCATION & IDENTIFICATION
- WEIR
- BRIDGE
- REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-9. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH EJ



LEGEND

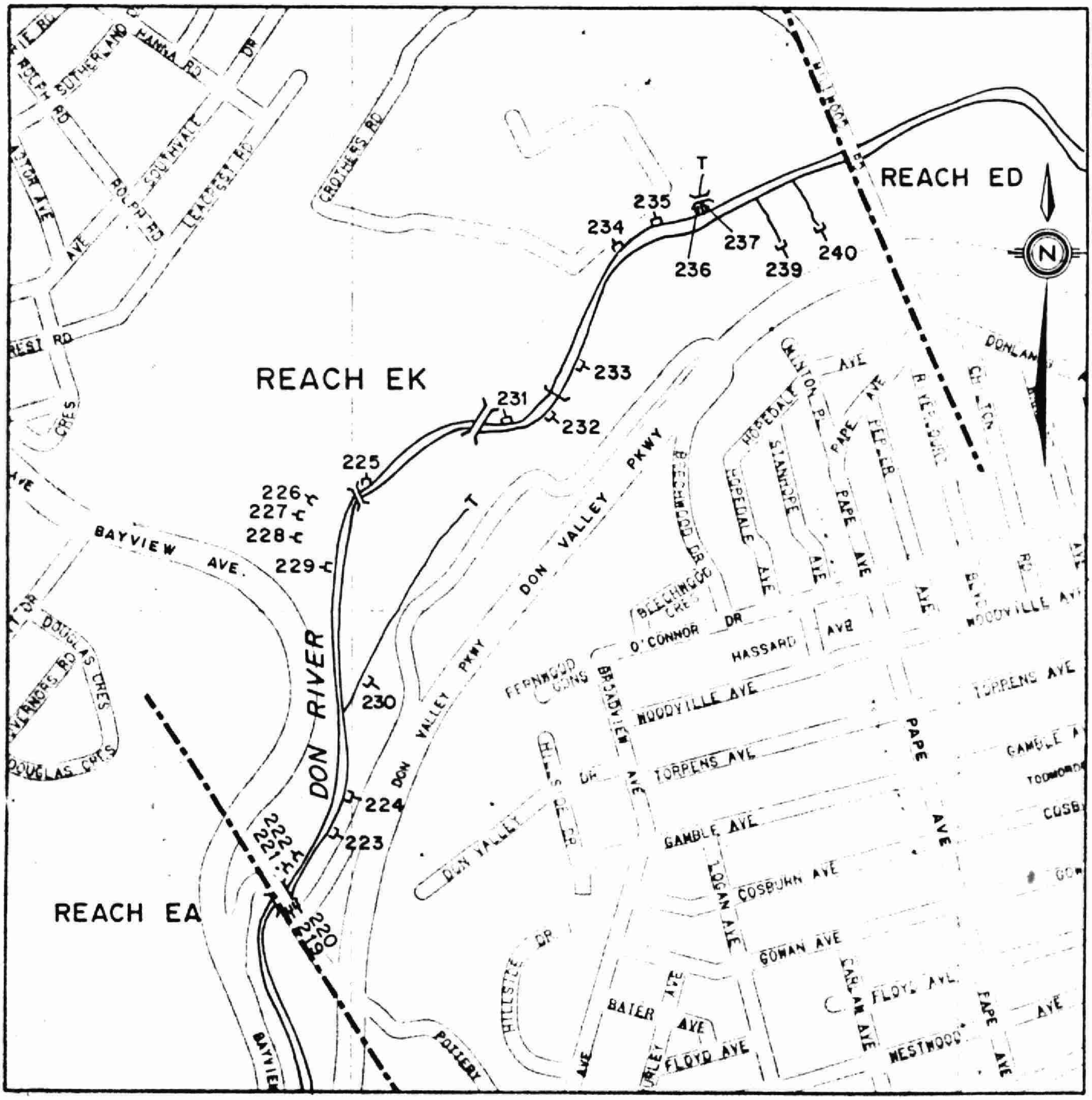
—804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-10. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH EK



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

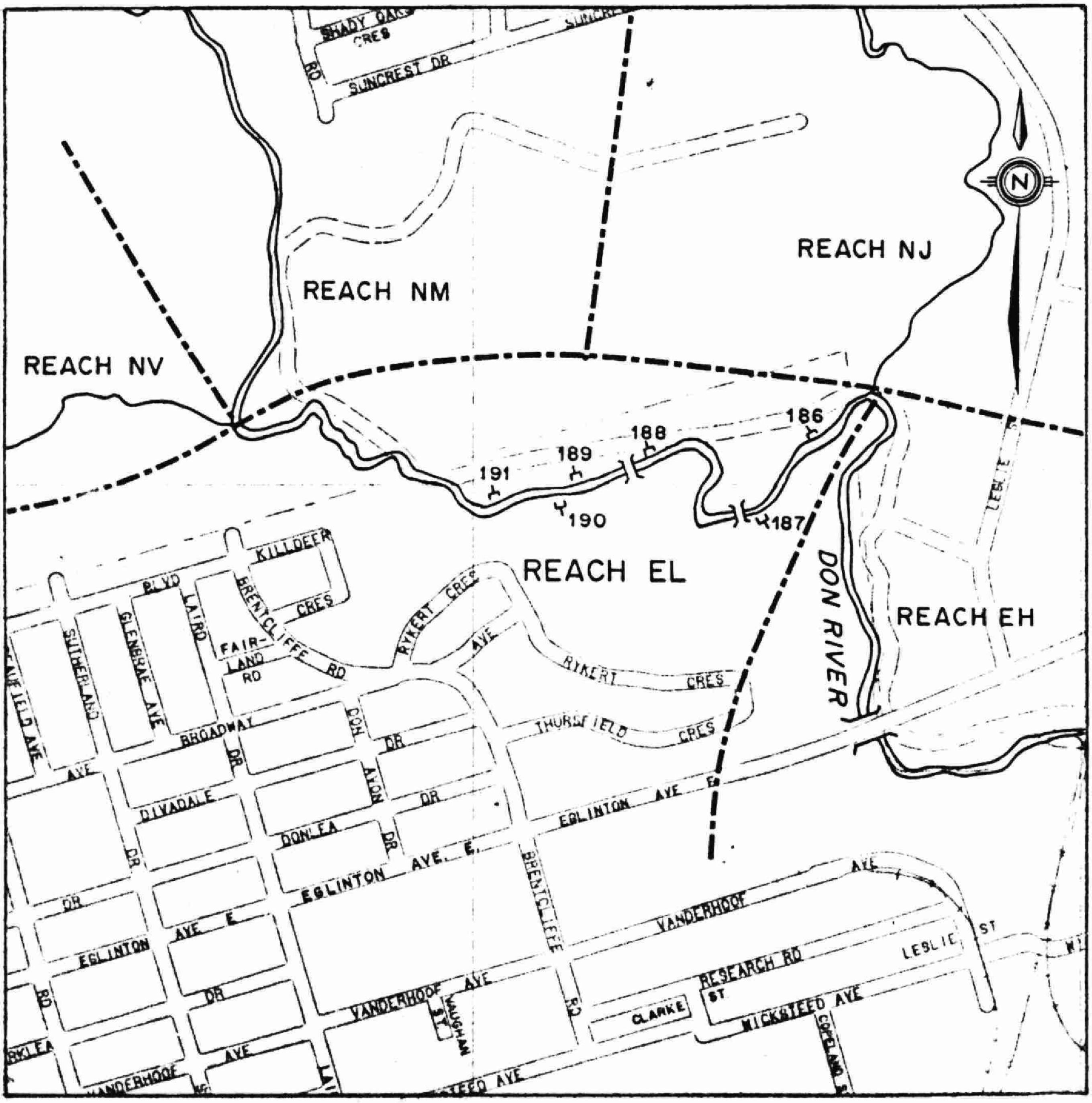
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-11. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH EL



LEGEND

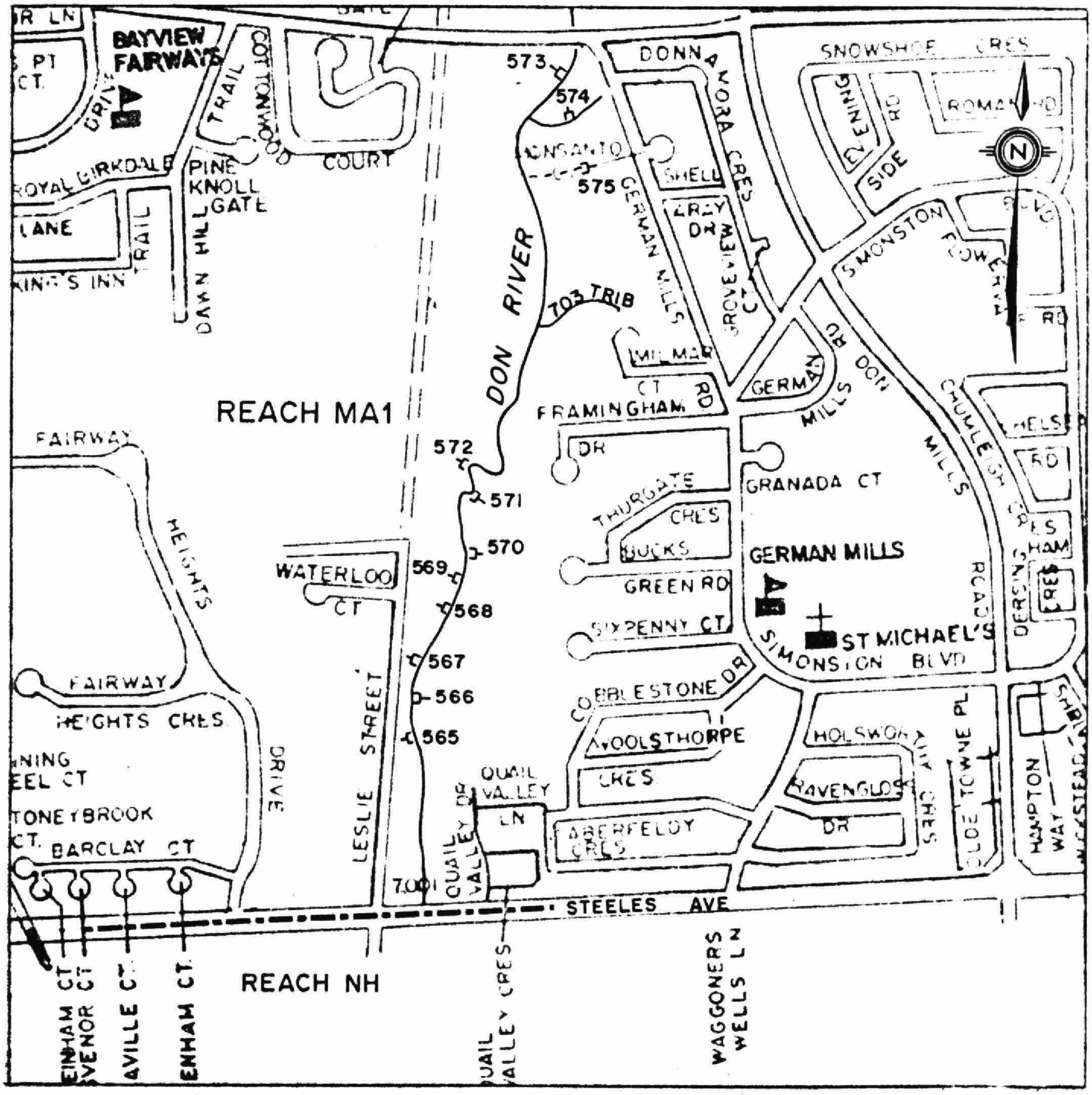
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-12. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH MA1



LEGEND

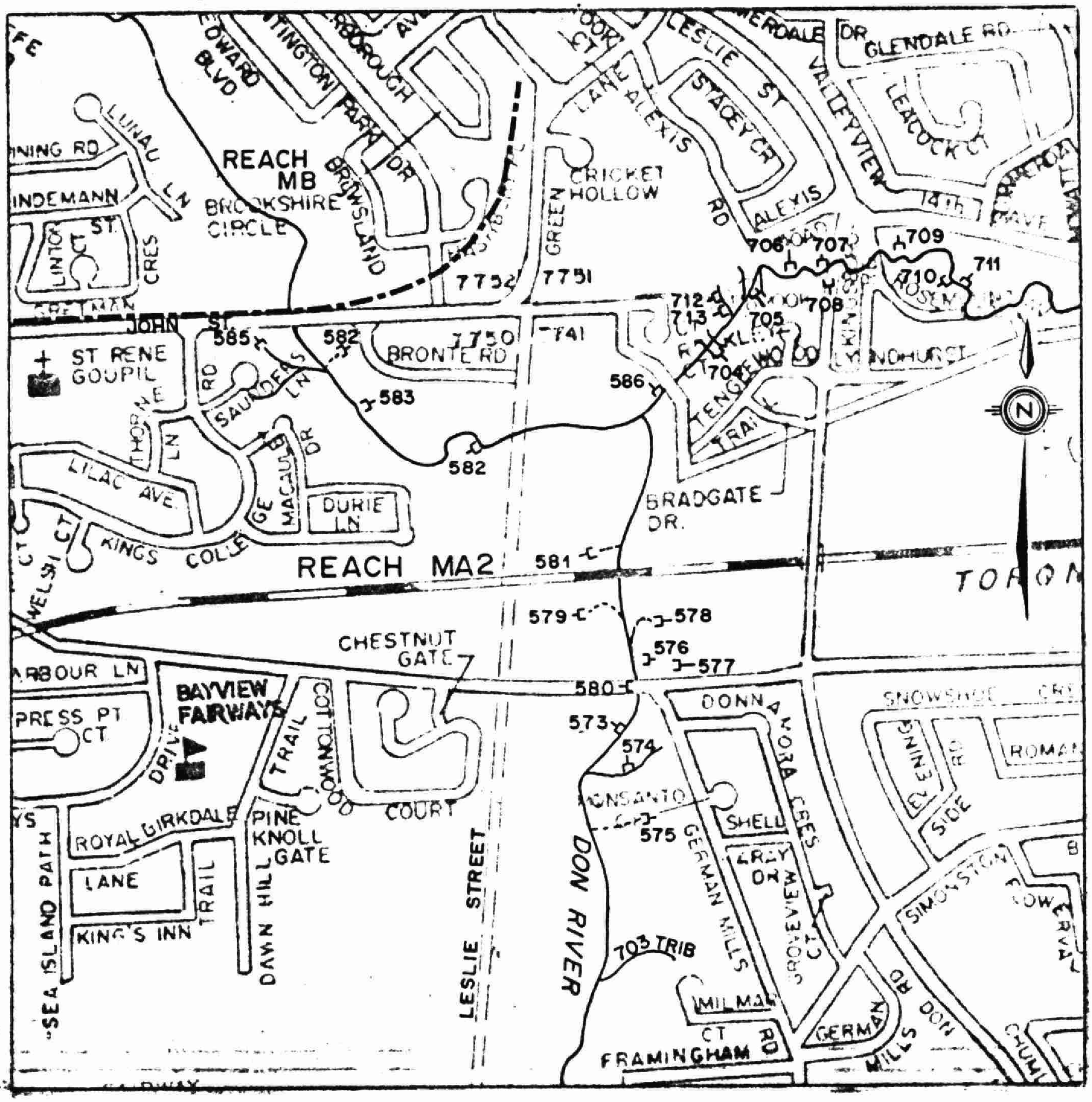
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-13. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH MA2



L E G E N D

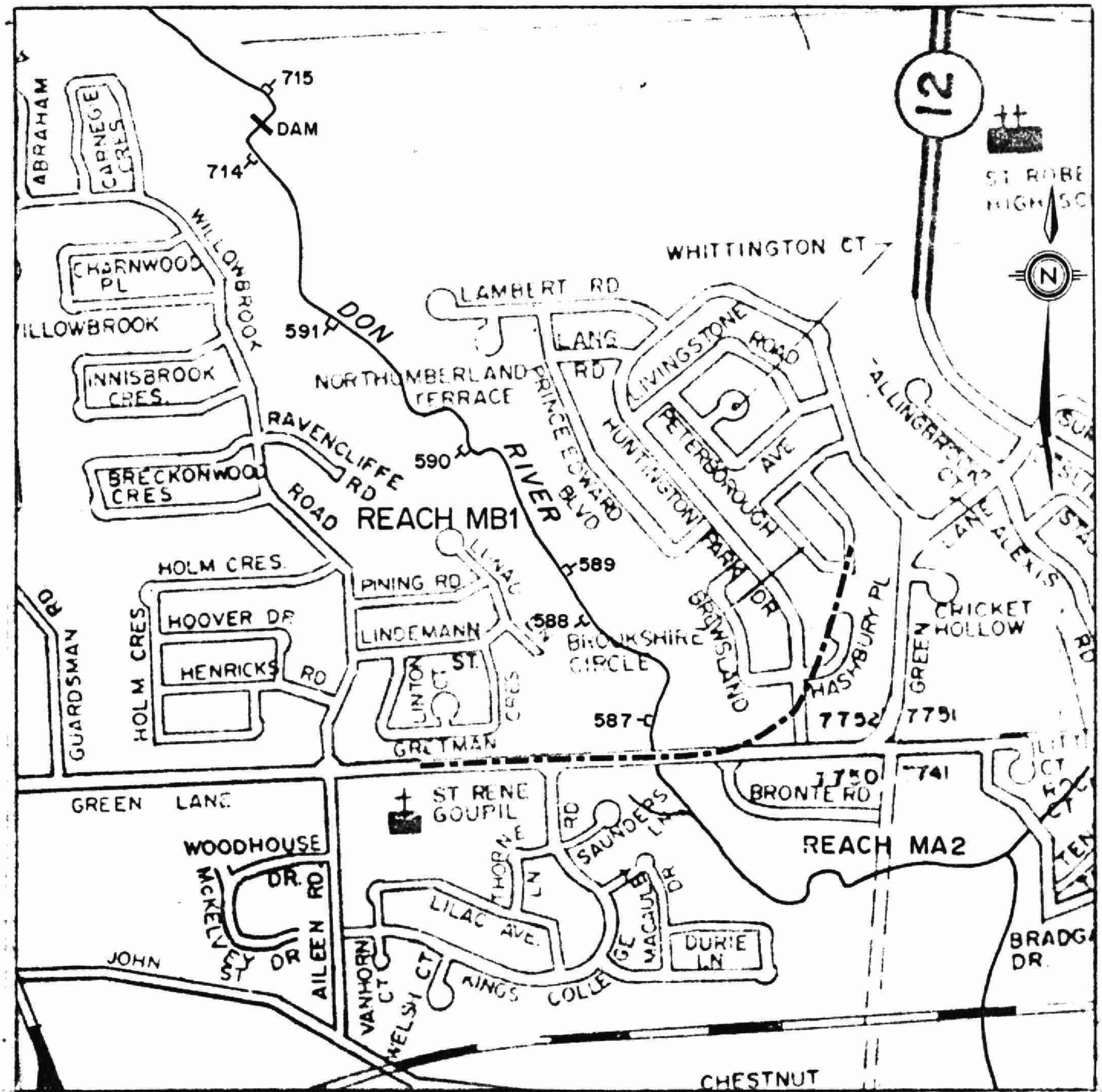
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-14. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH MB1



LEGEND

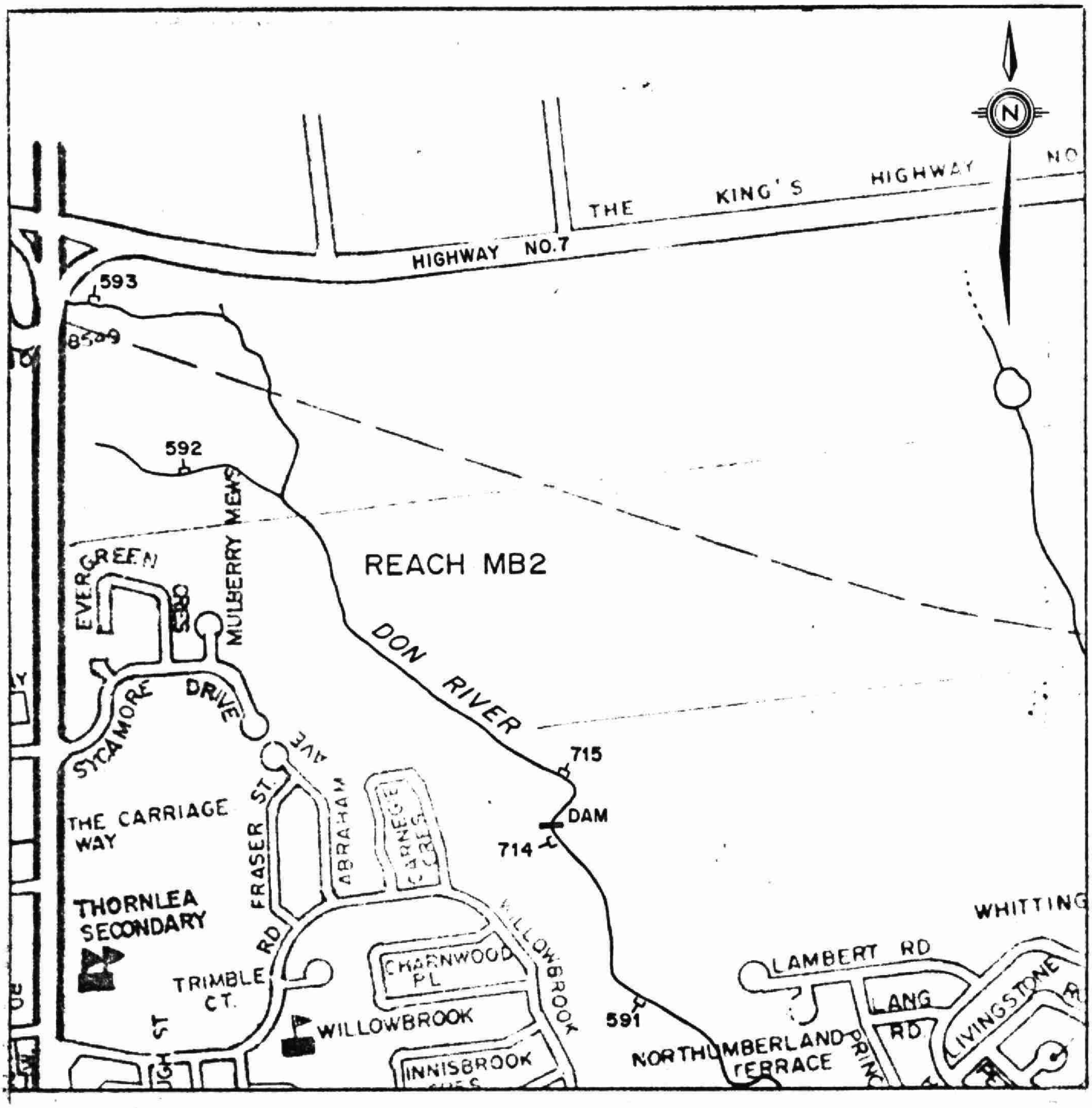
—804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-15. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH MB2



L E G E N D

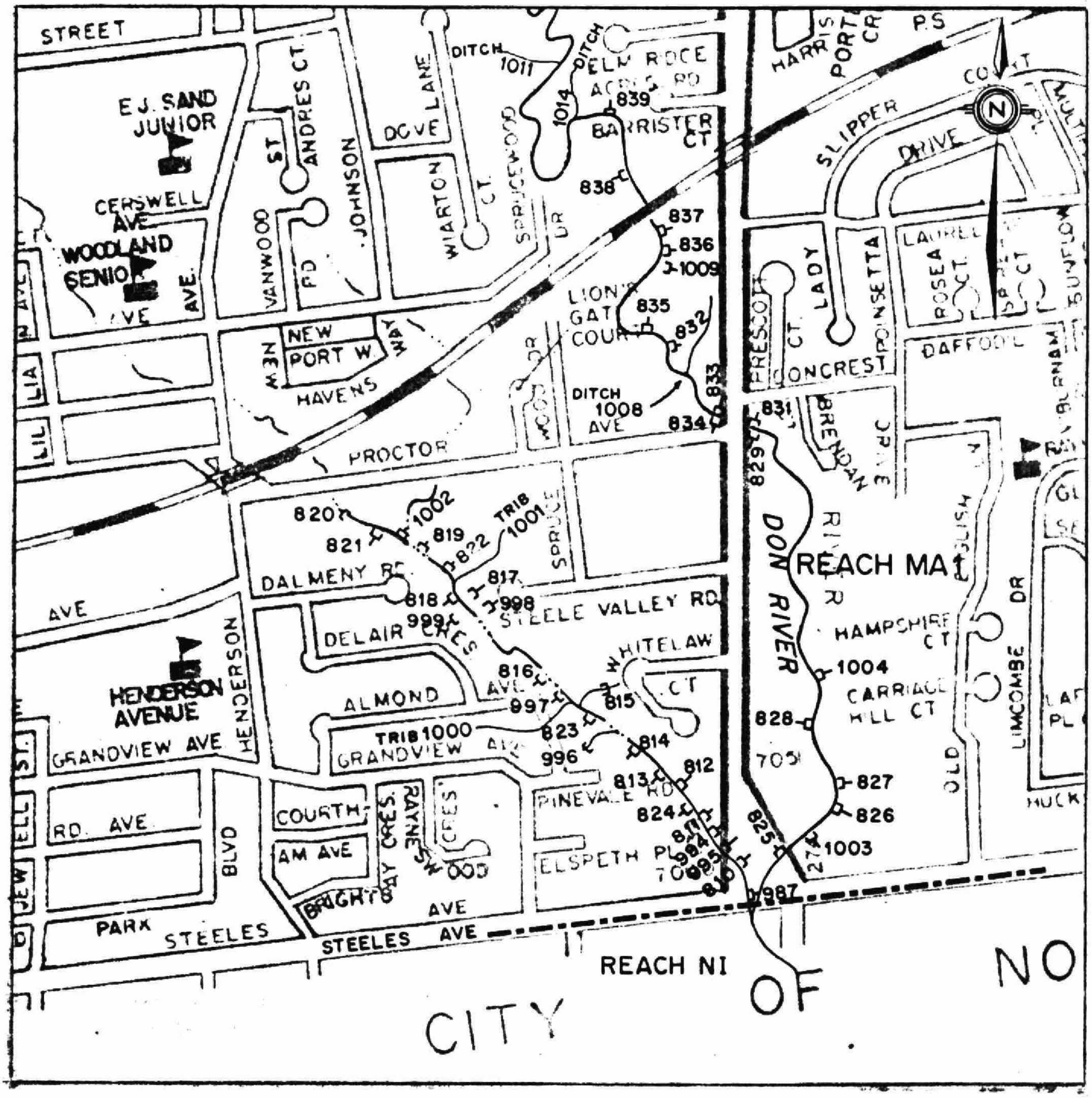
- 804 OUTFALL LOCATION & IDENTIFICATION
- WEIR
- BRIDGE
- REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD.

FIGURE I-16. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH MD1



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

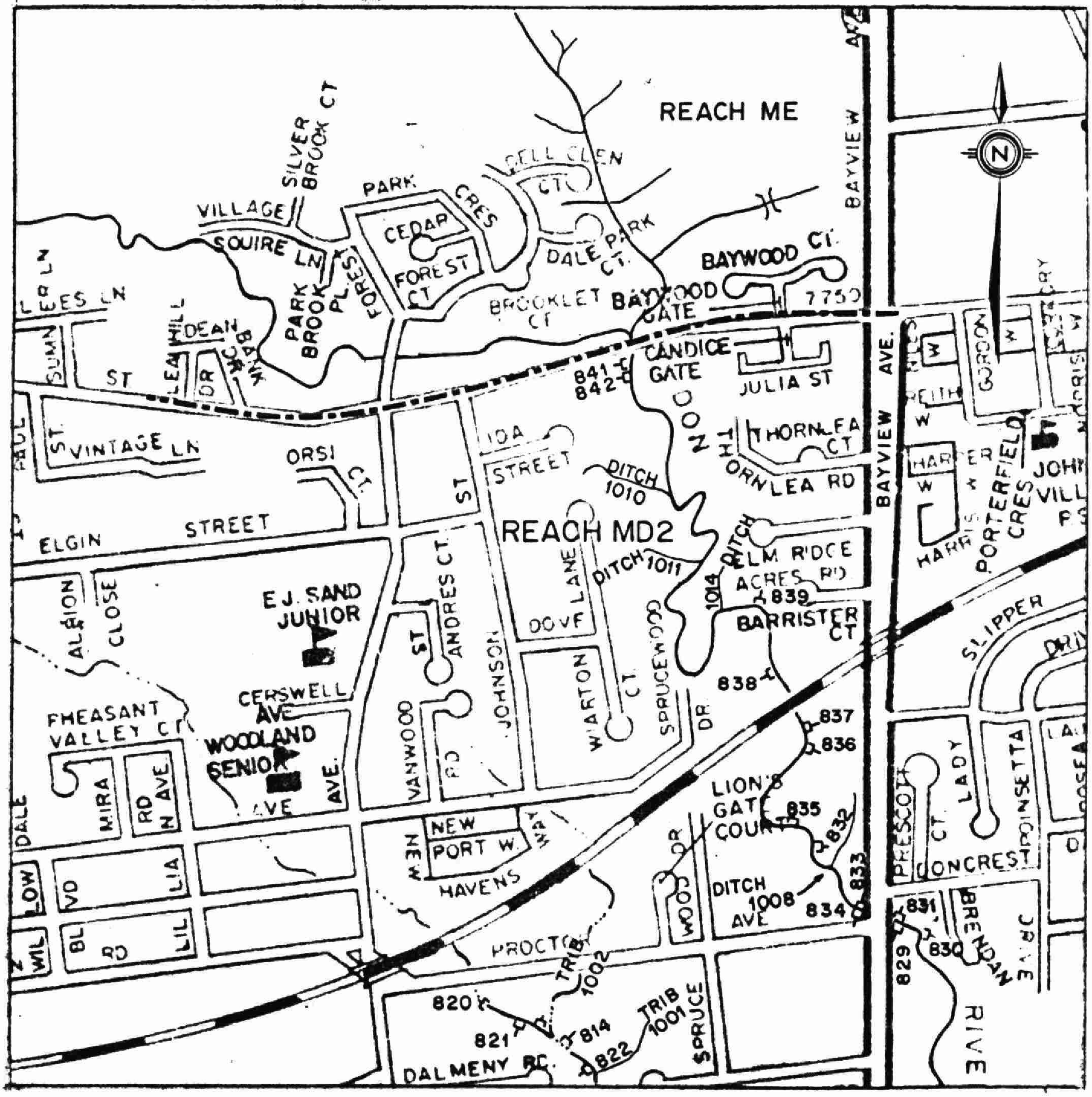
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-17. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH MD2



LEGEND

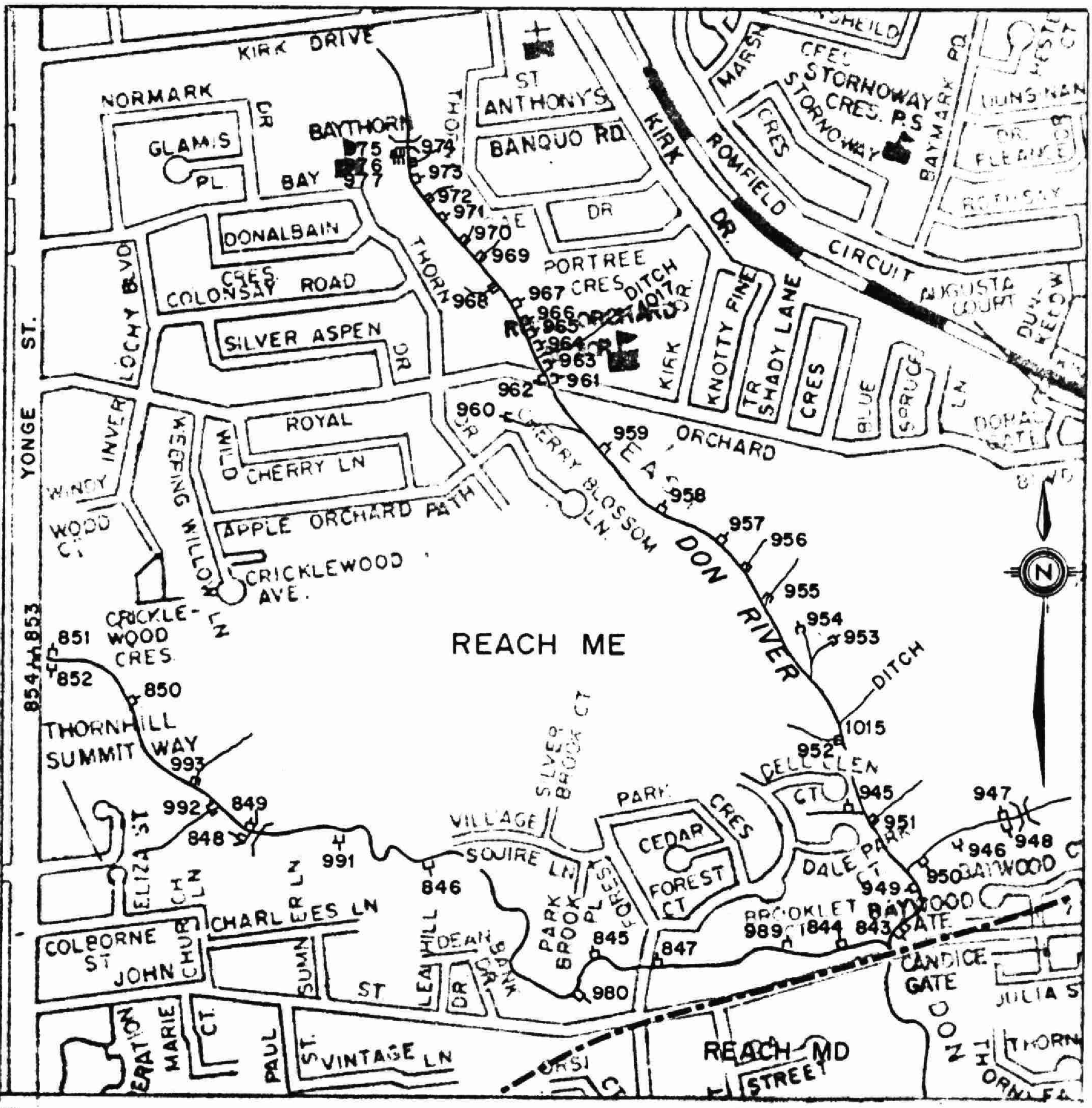
- 804 OUTFALL LOCATION & IDENTIFICATION
- WEIR
- BRIDGE
- REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-18. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH ME



LEGEND

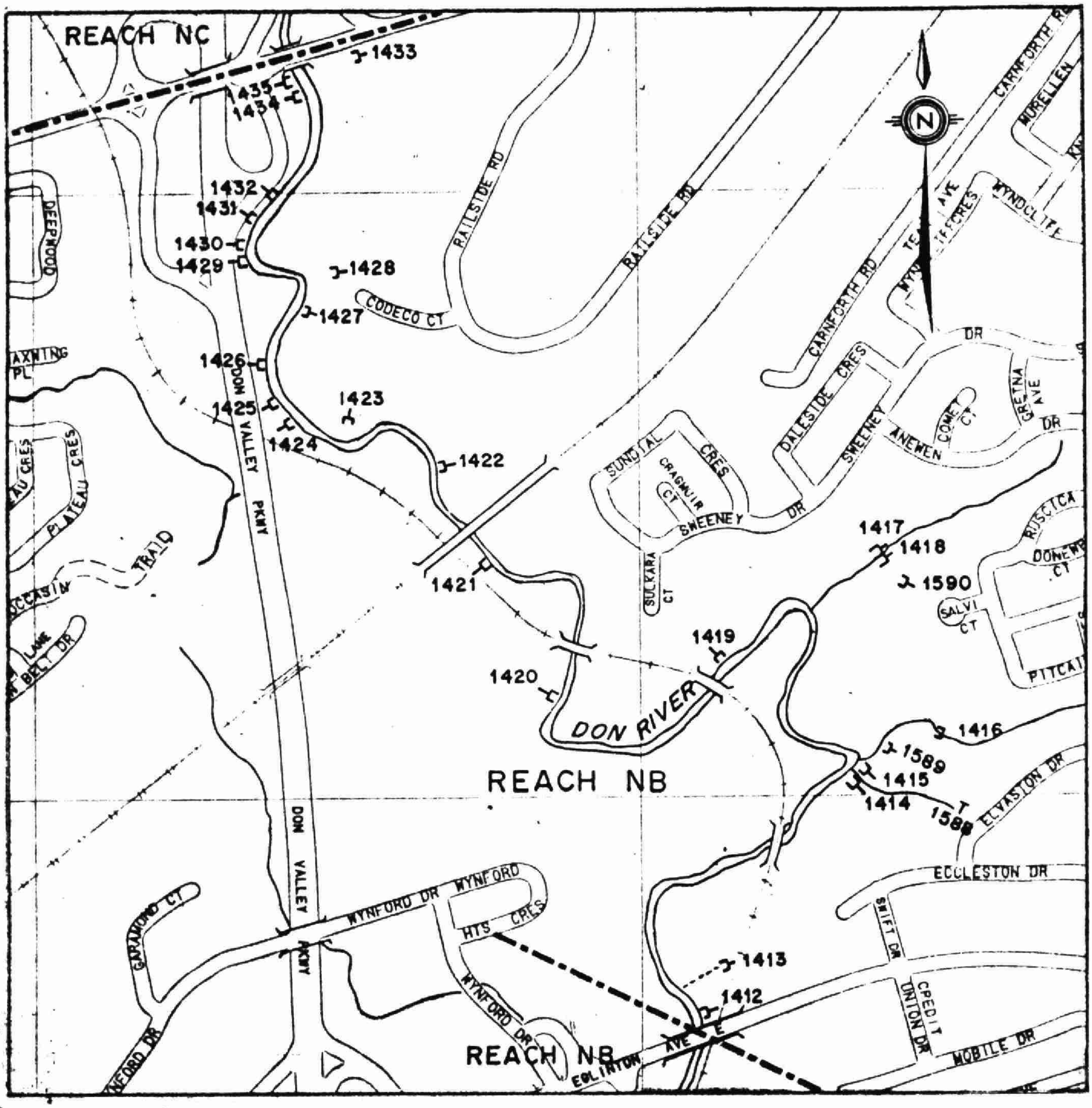
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-19. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NB



LEGEND

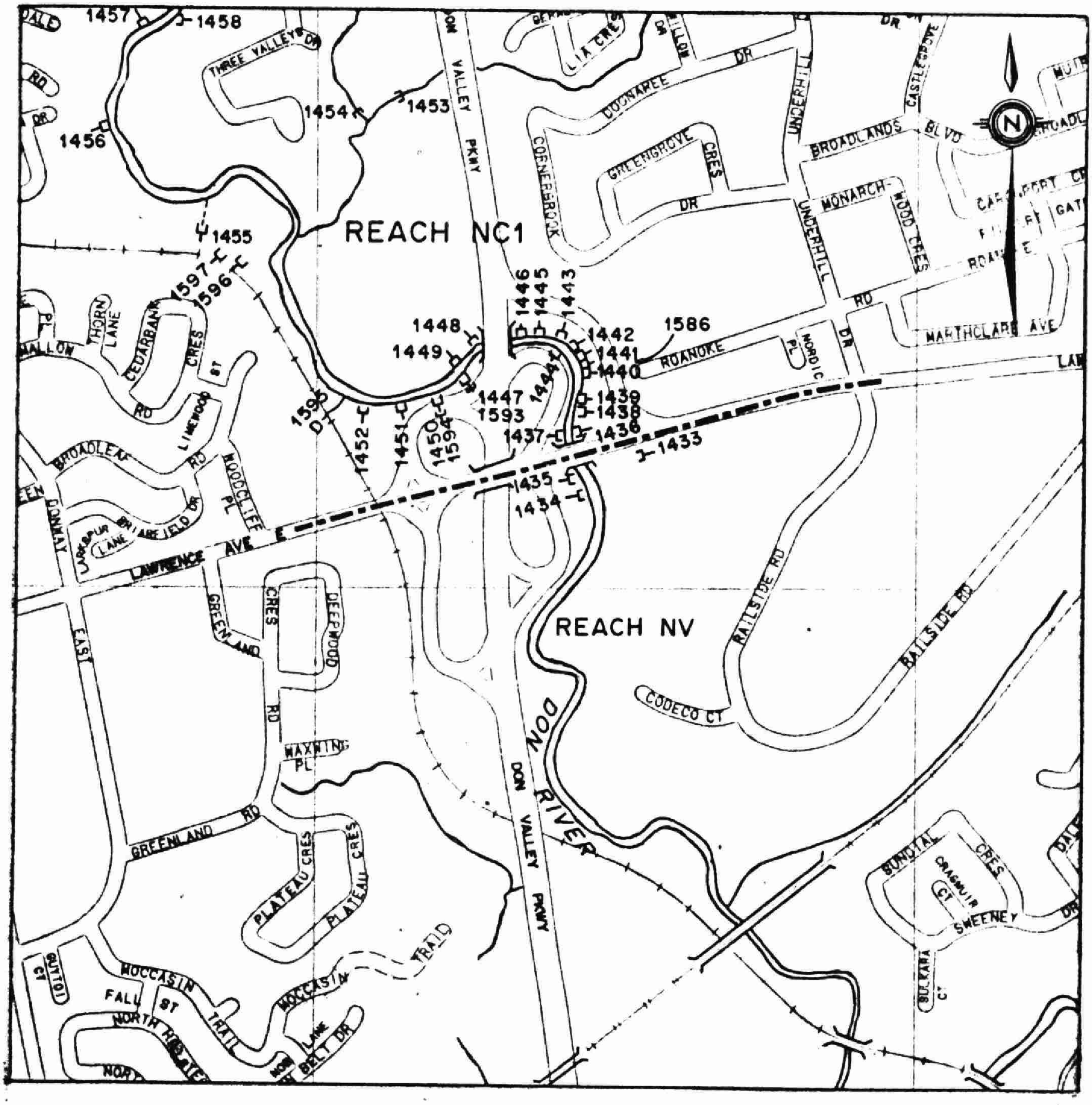
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD.

FIGURE I-20. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NC1



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

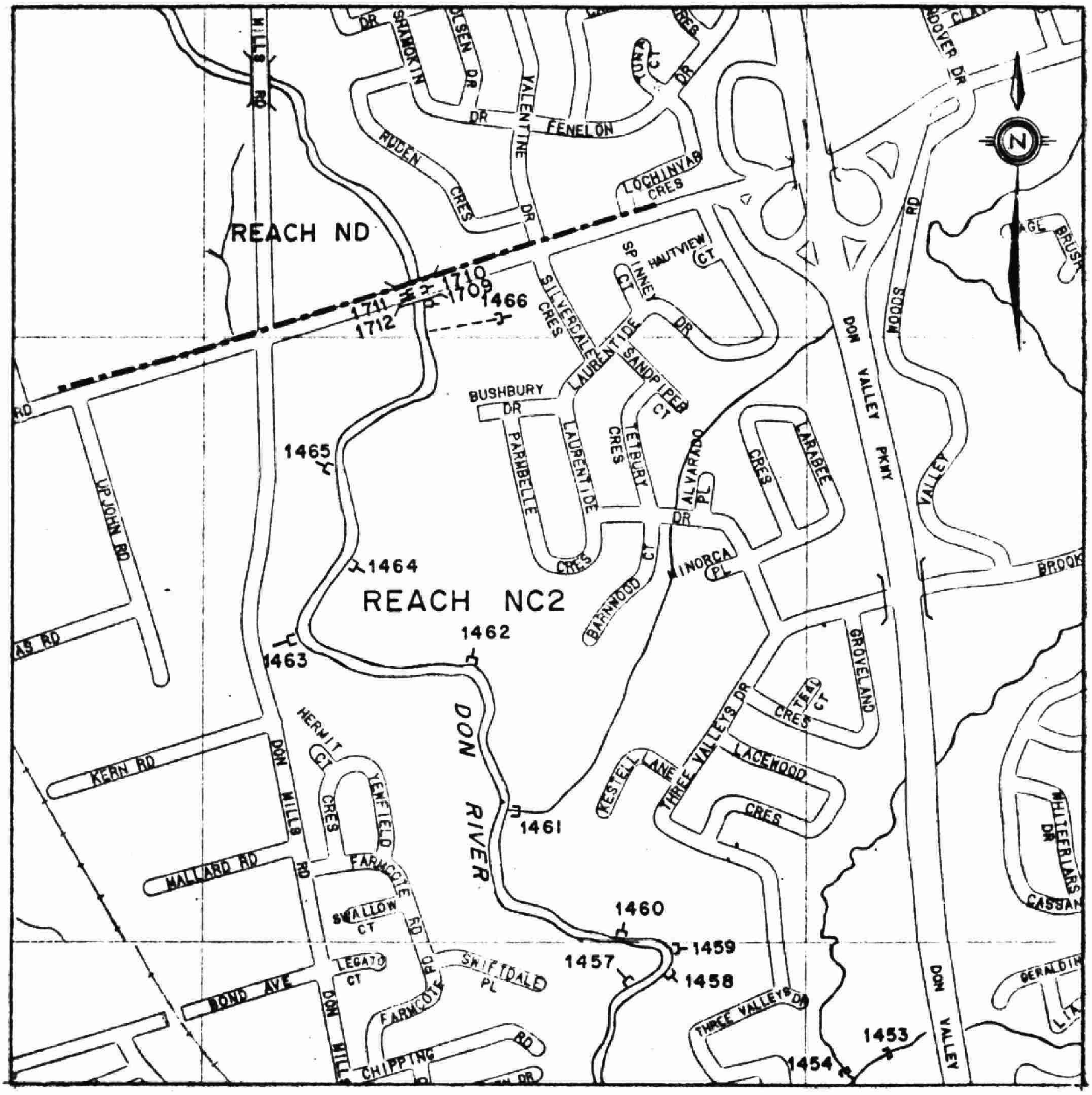
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD.

FIGURE I-21. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NC2



LEGEND

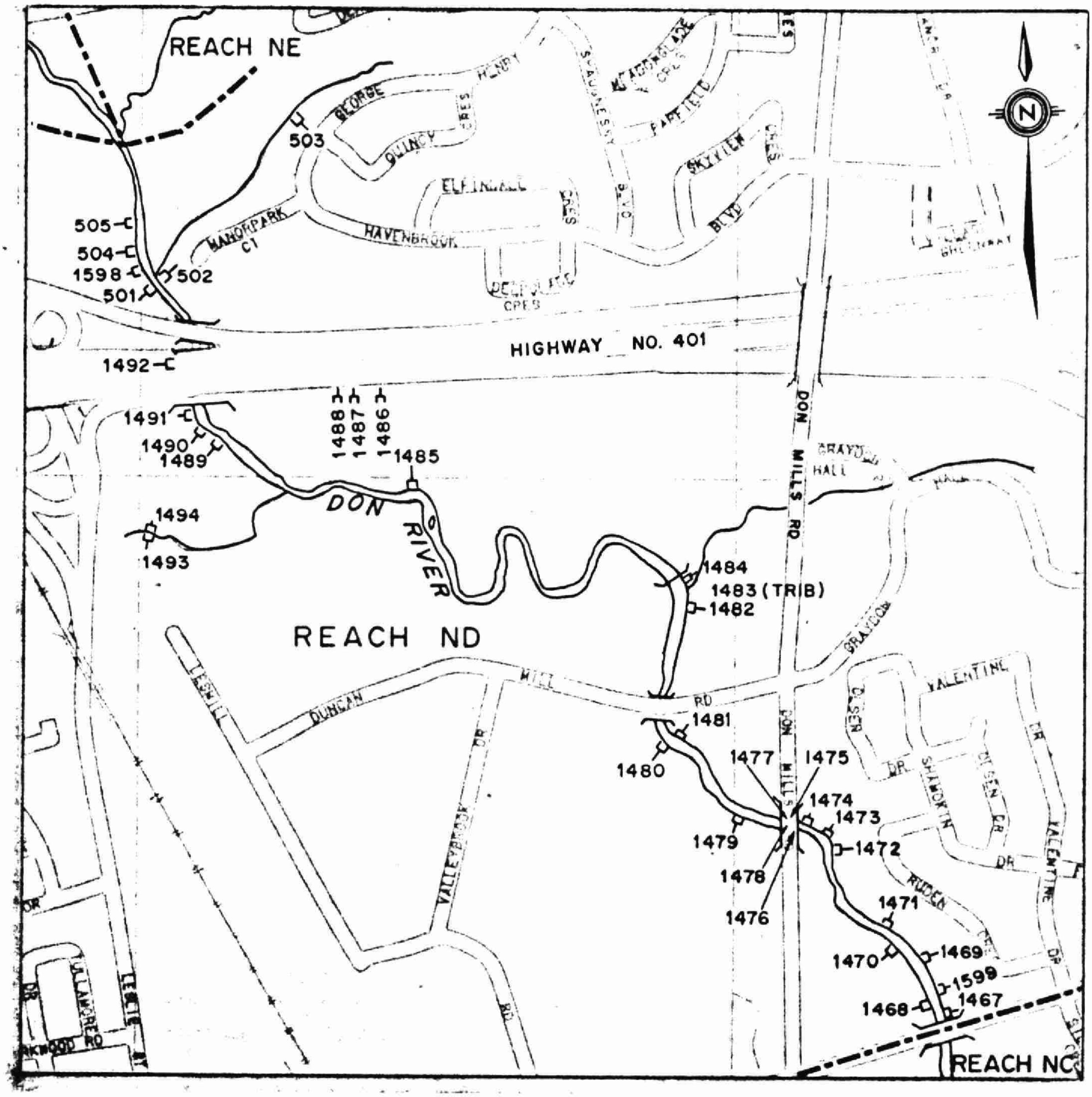
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-22. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH ND



LEGEND

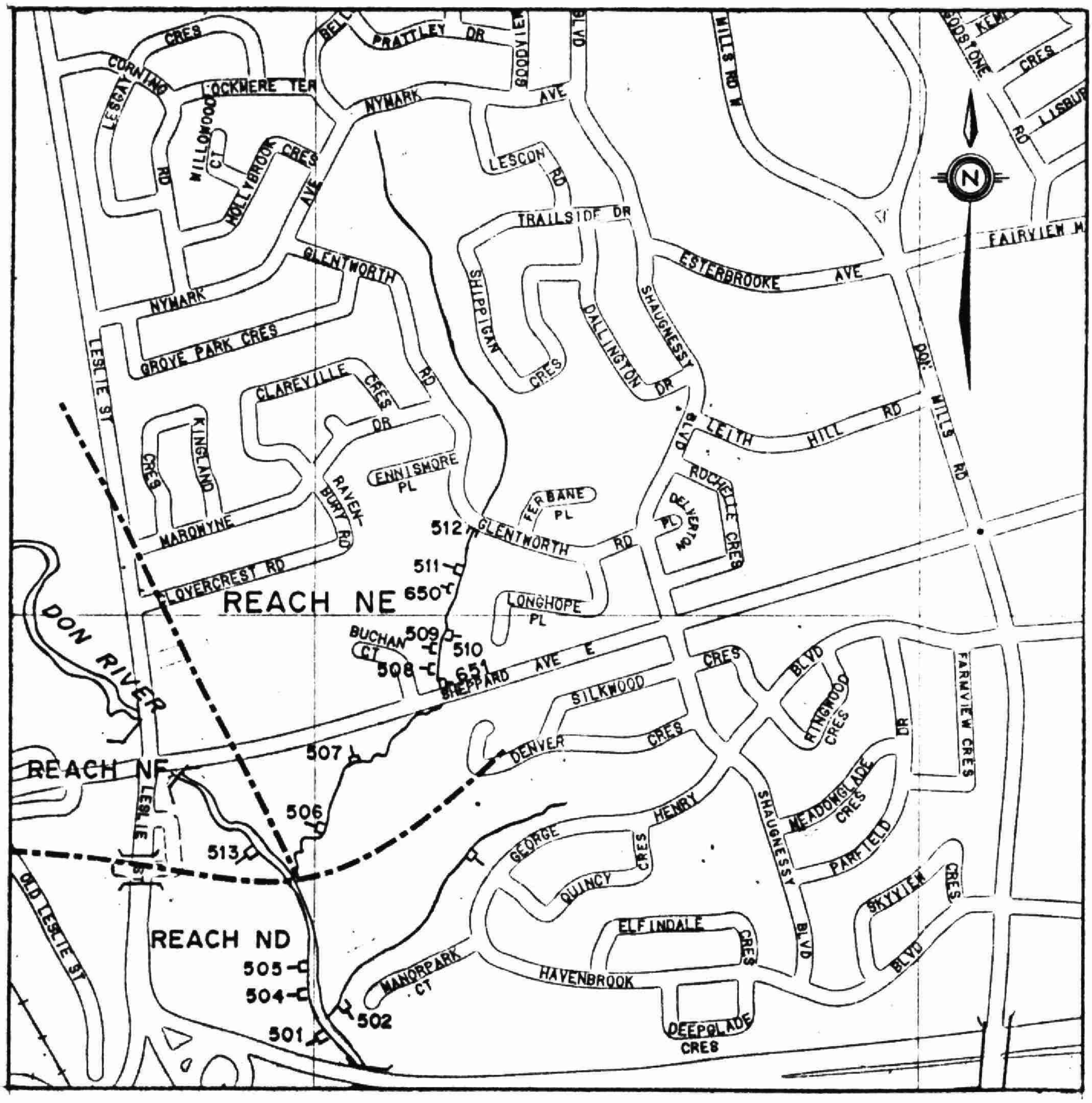
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-23. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NE



LEGEND

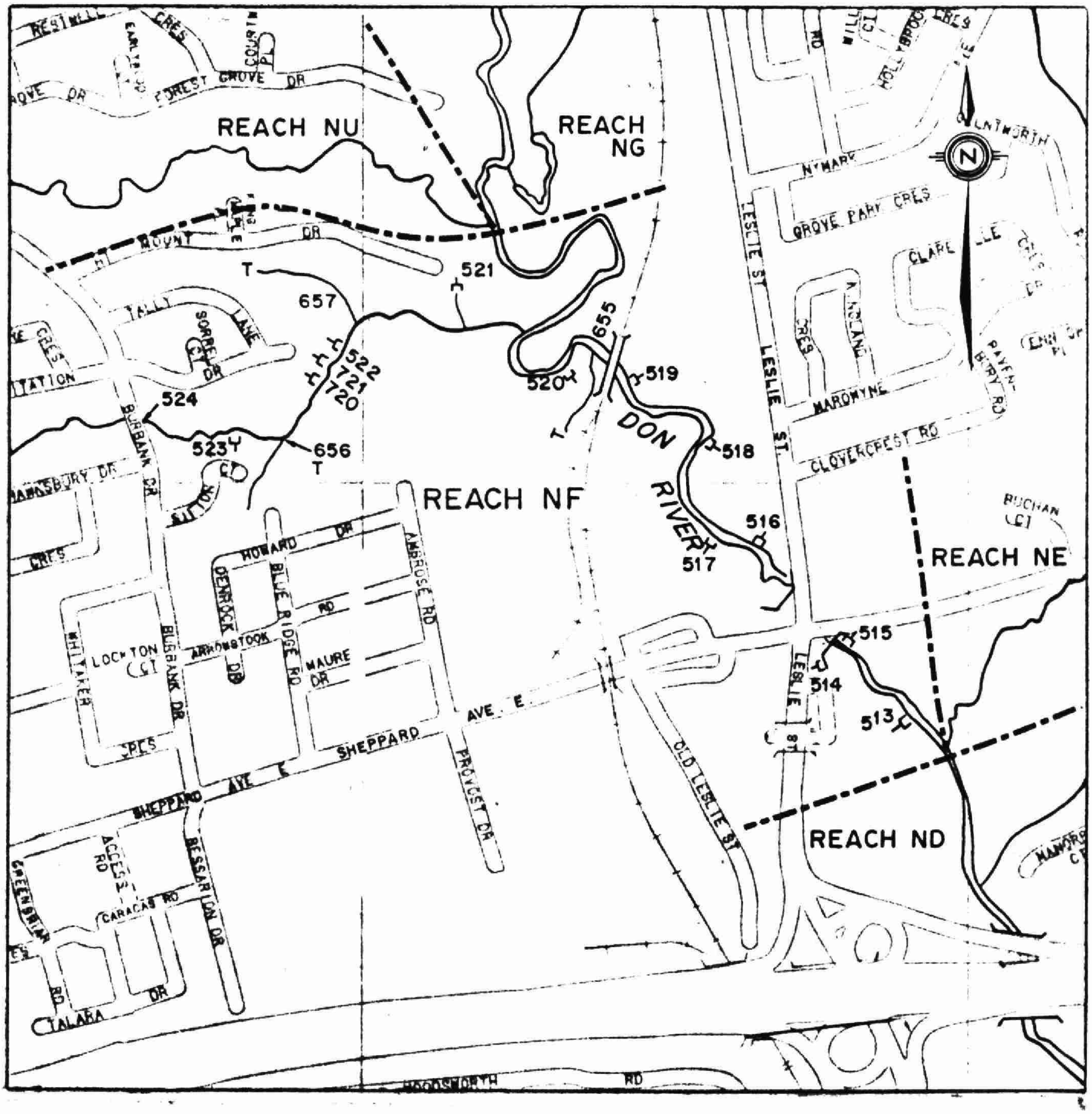
—804	OUTFALL LOCATION & IDENTIFICATION
⌒	WEIR
≍	BRIDGE
— · —	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-24. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NF



LEGEND

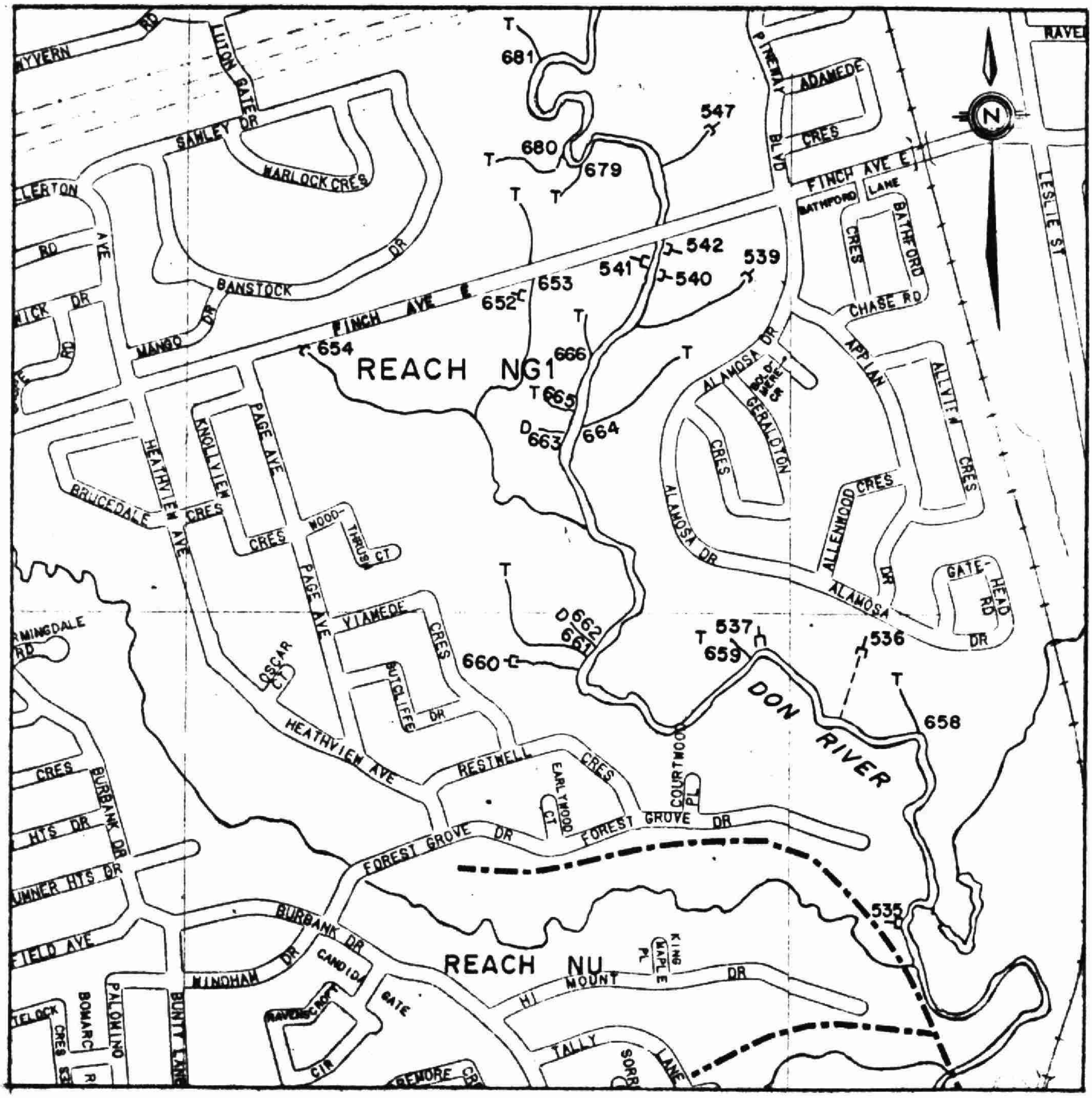
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD.

FIGURE I-25. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NG1



L E G E N D

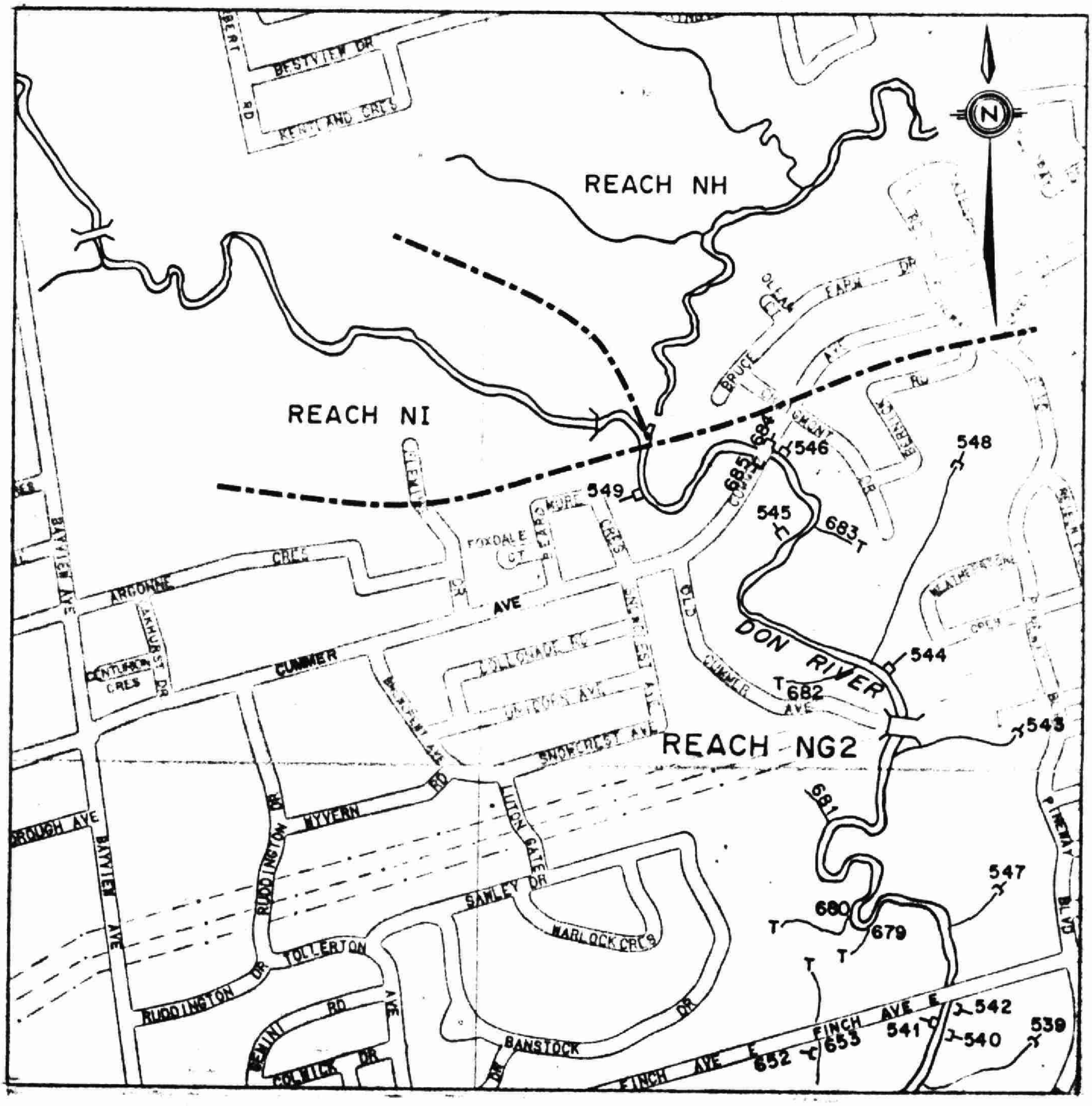
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-26. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NG2



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

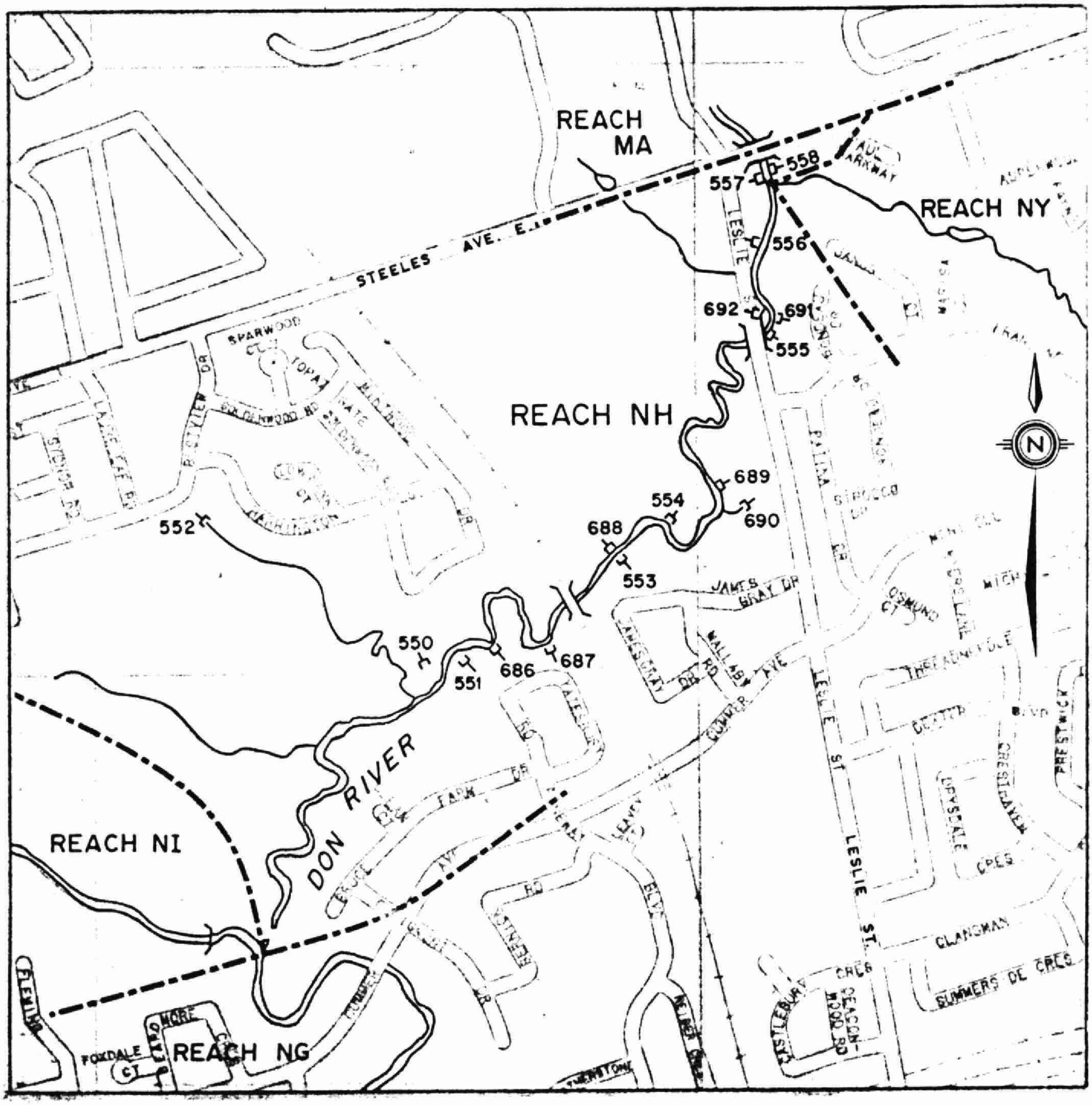
REACH BOUNDARY

SCALE 1:10000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD.

FIGURE I-27. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NH



LEGEND

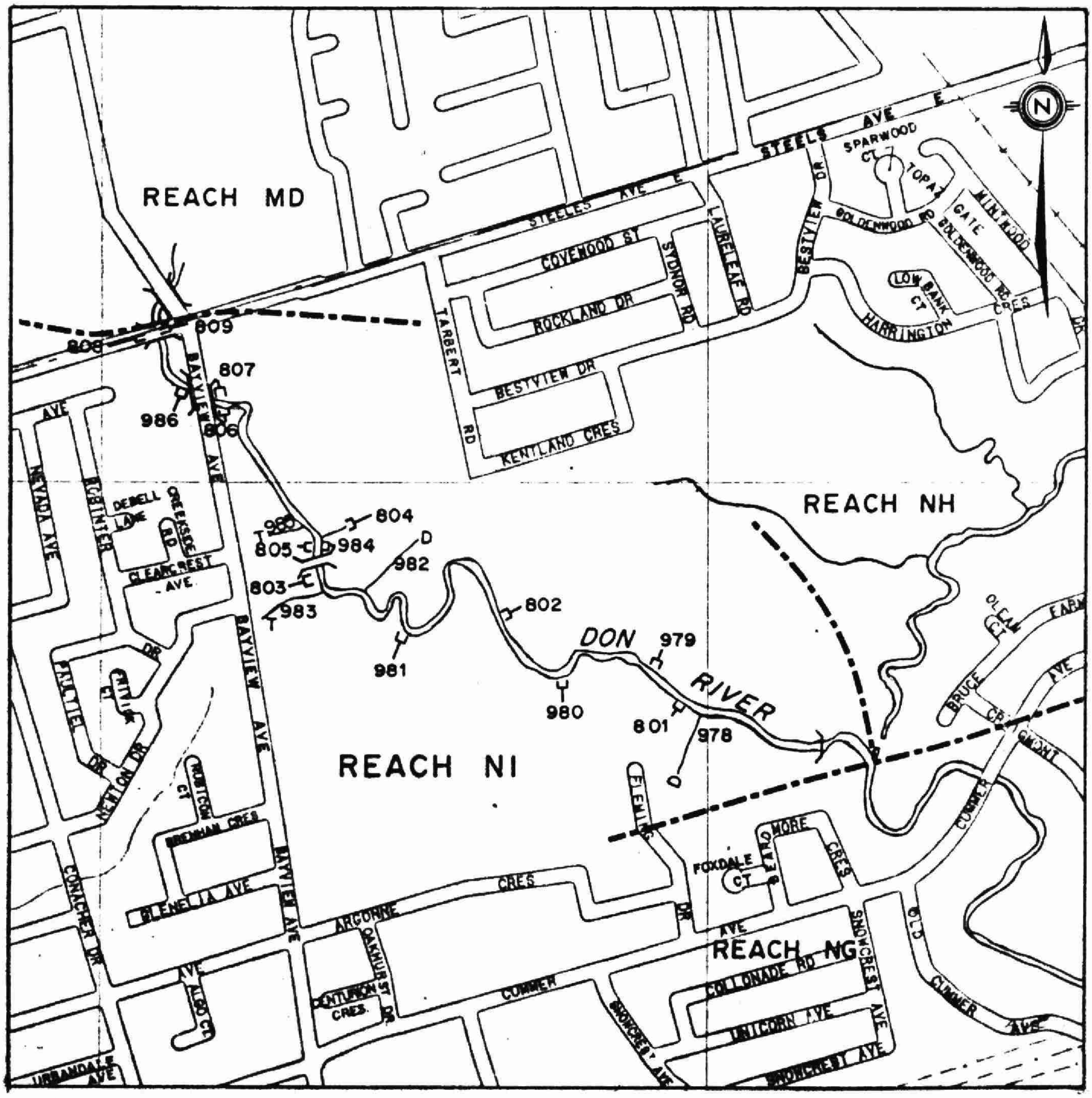
⊐– 804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
–·–·–	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-28. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NI



L E G E N D

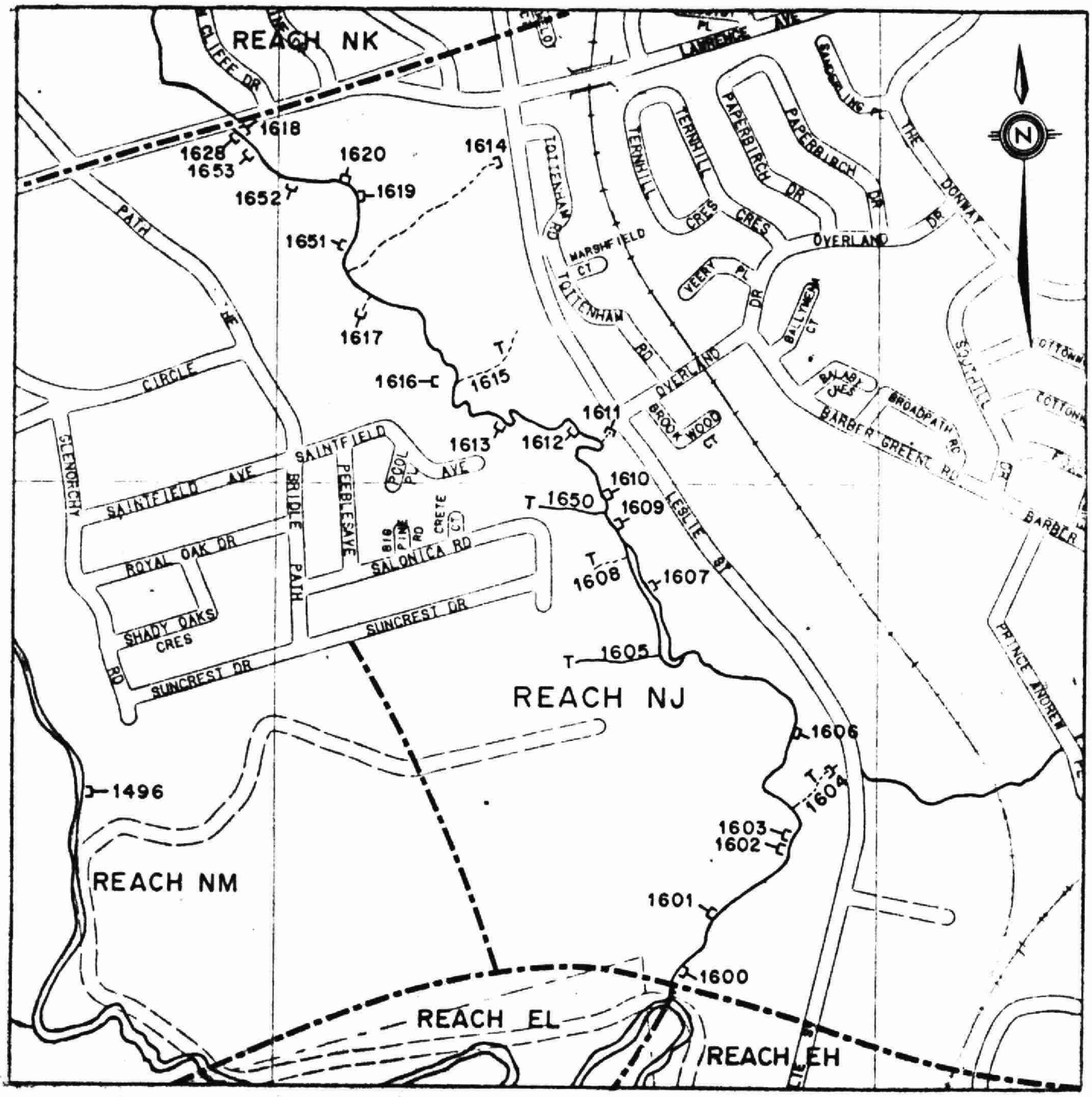
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-29. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NJ



LEGEND

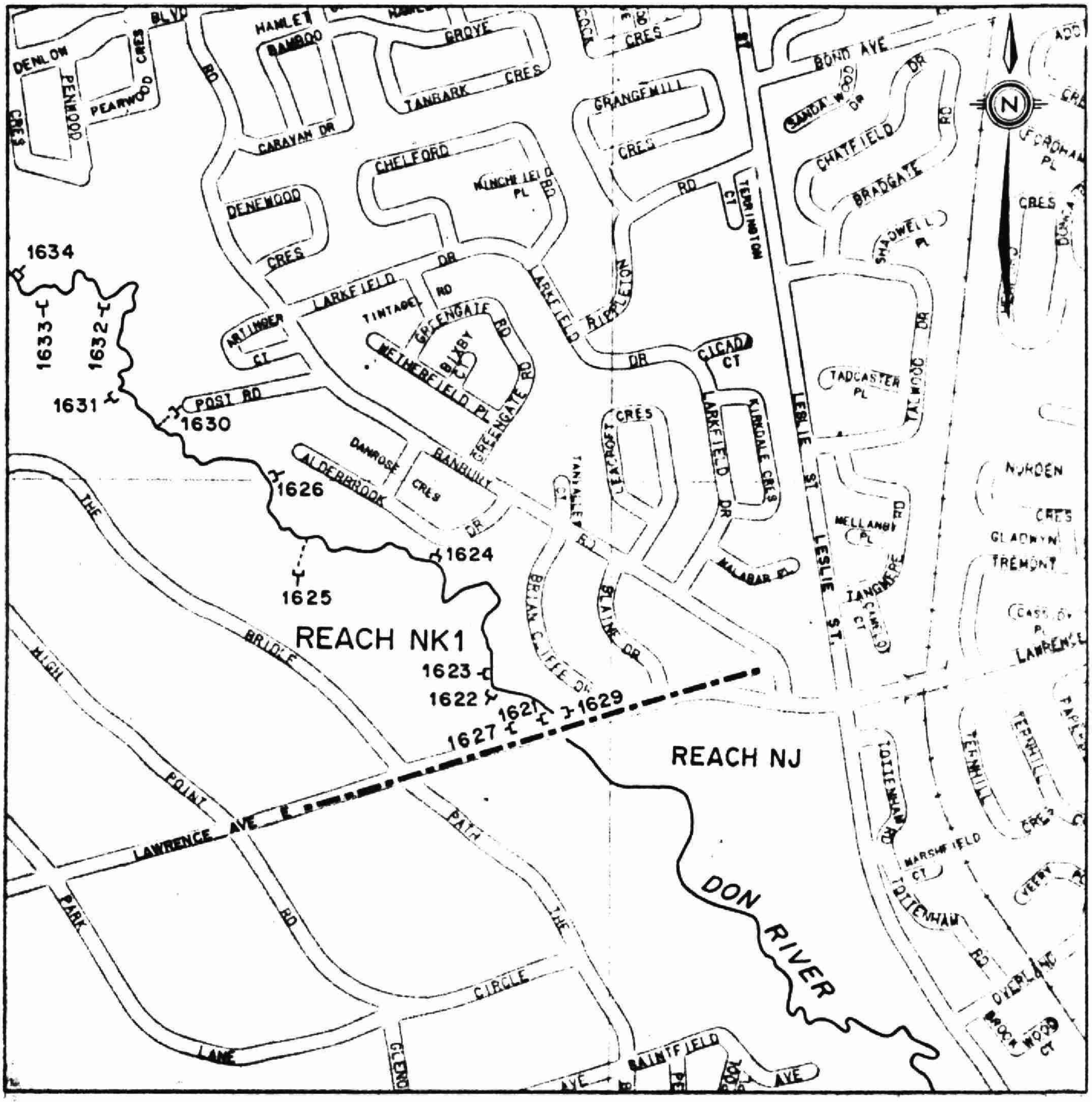
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-30. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NK1



LEGEND

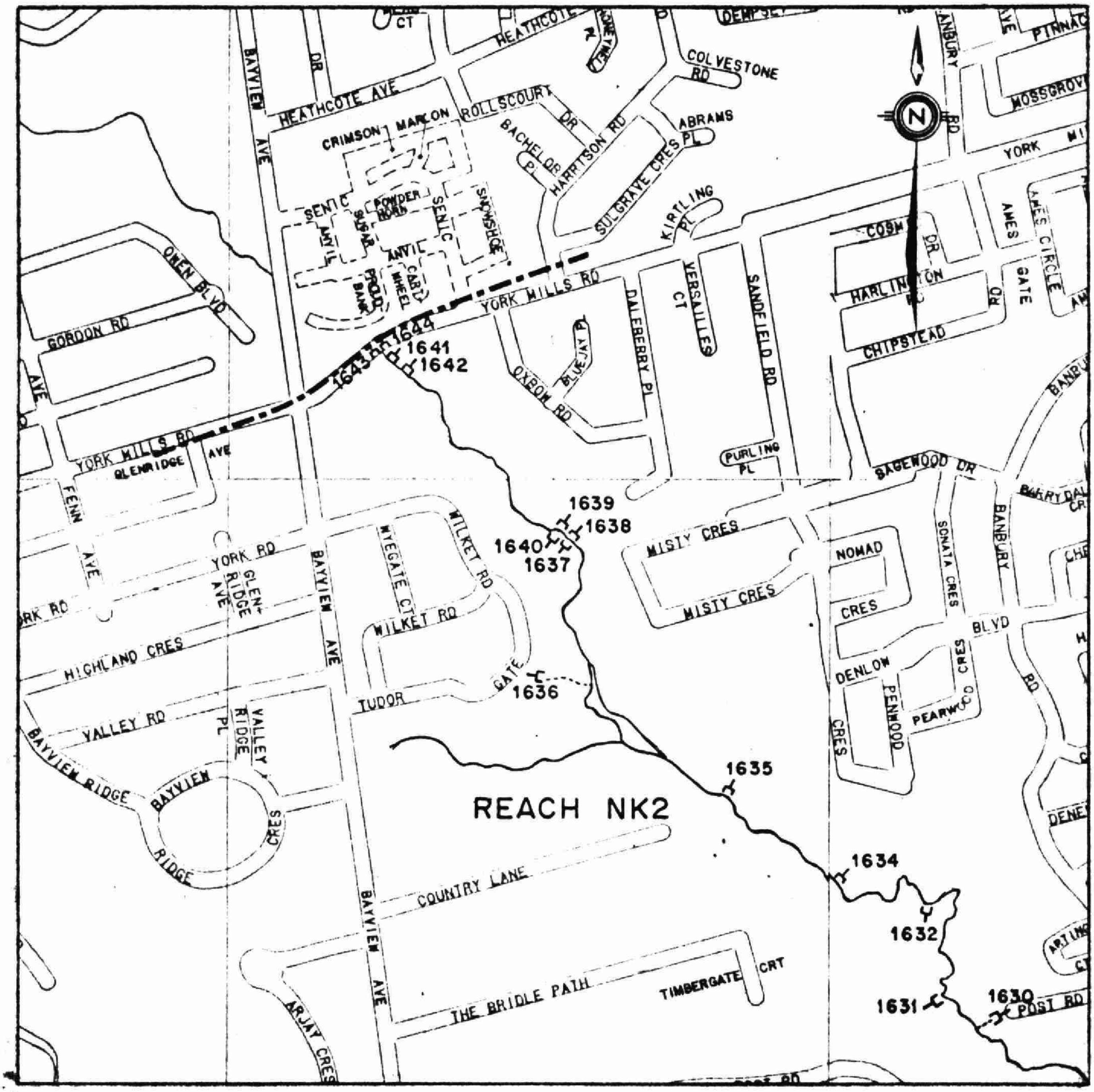
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-31. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NK2



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

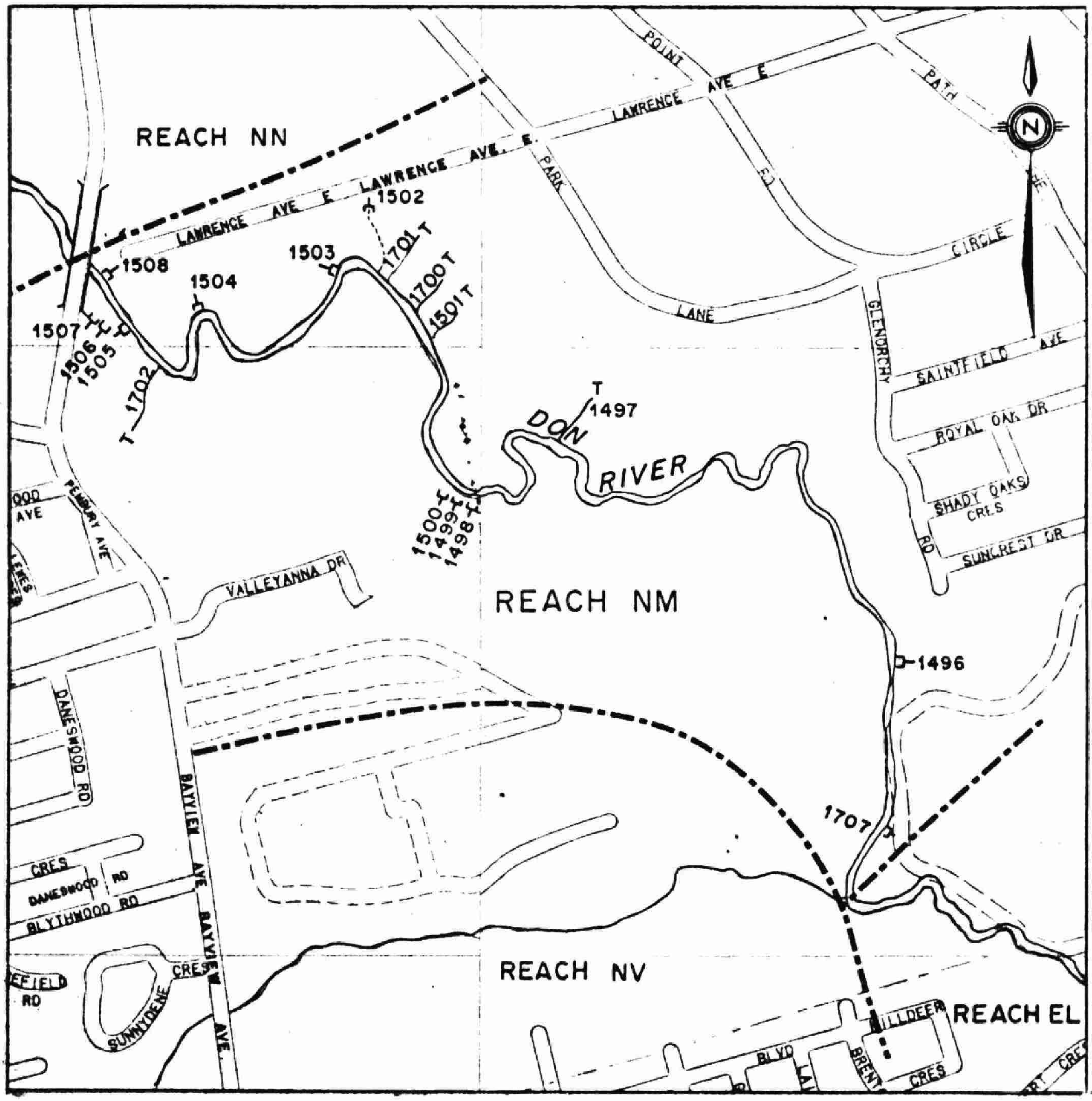
REACH BOUNDARY

SCALE 1:10000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-32. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NM



LEGEND

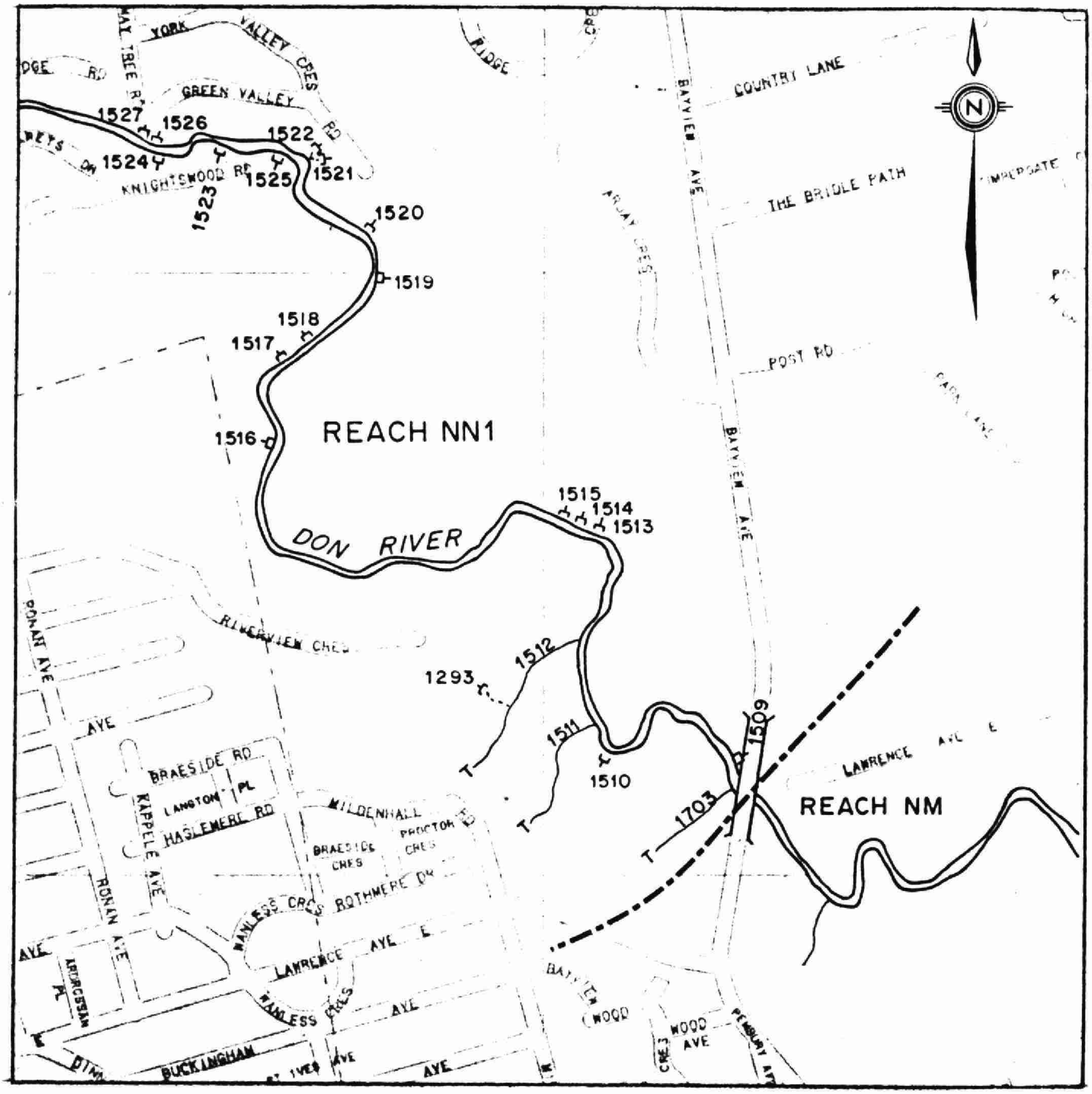
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-33. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NN1



LEGEND

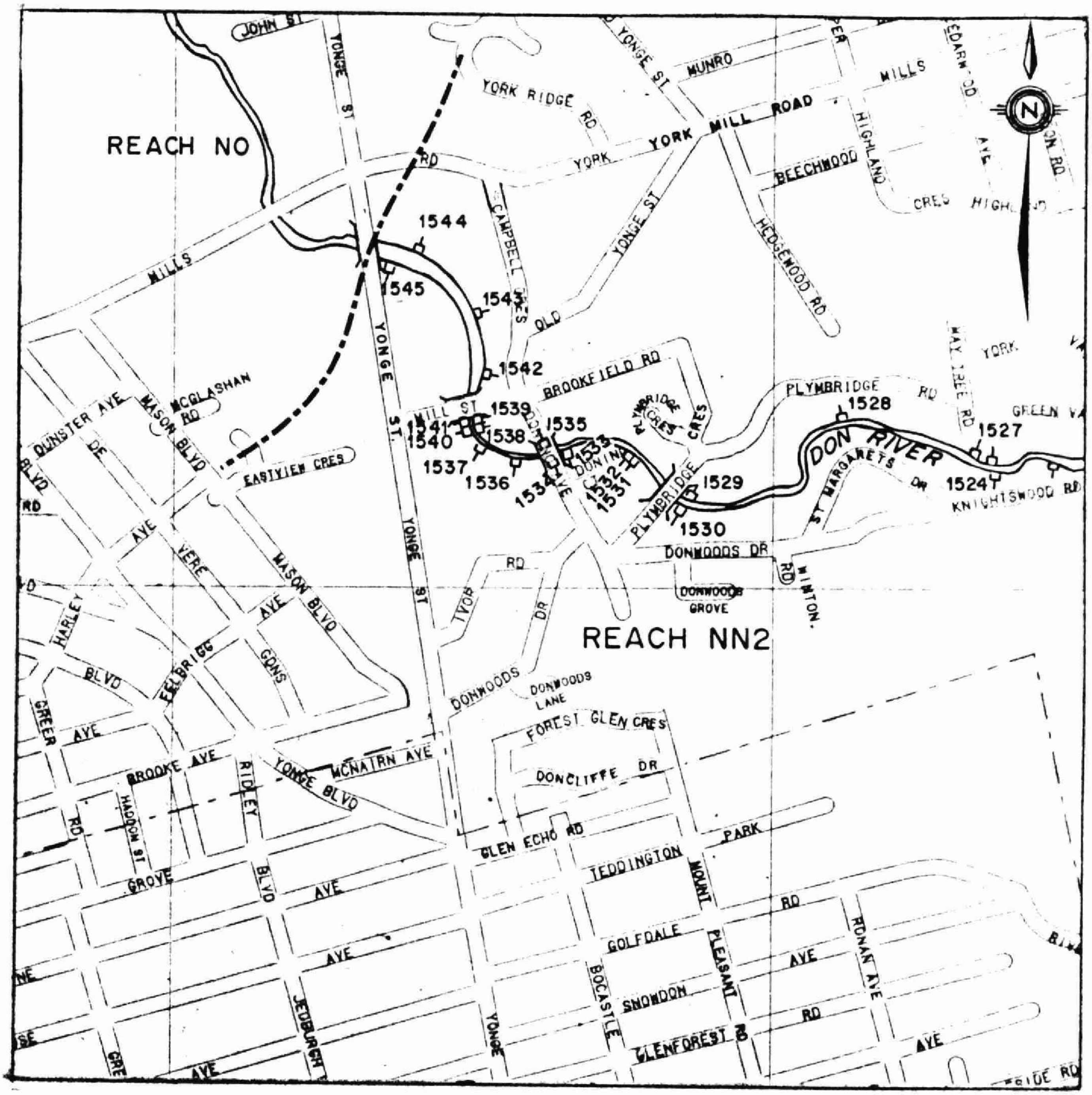
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-34. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NN2



L E G E N D

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

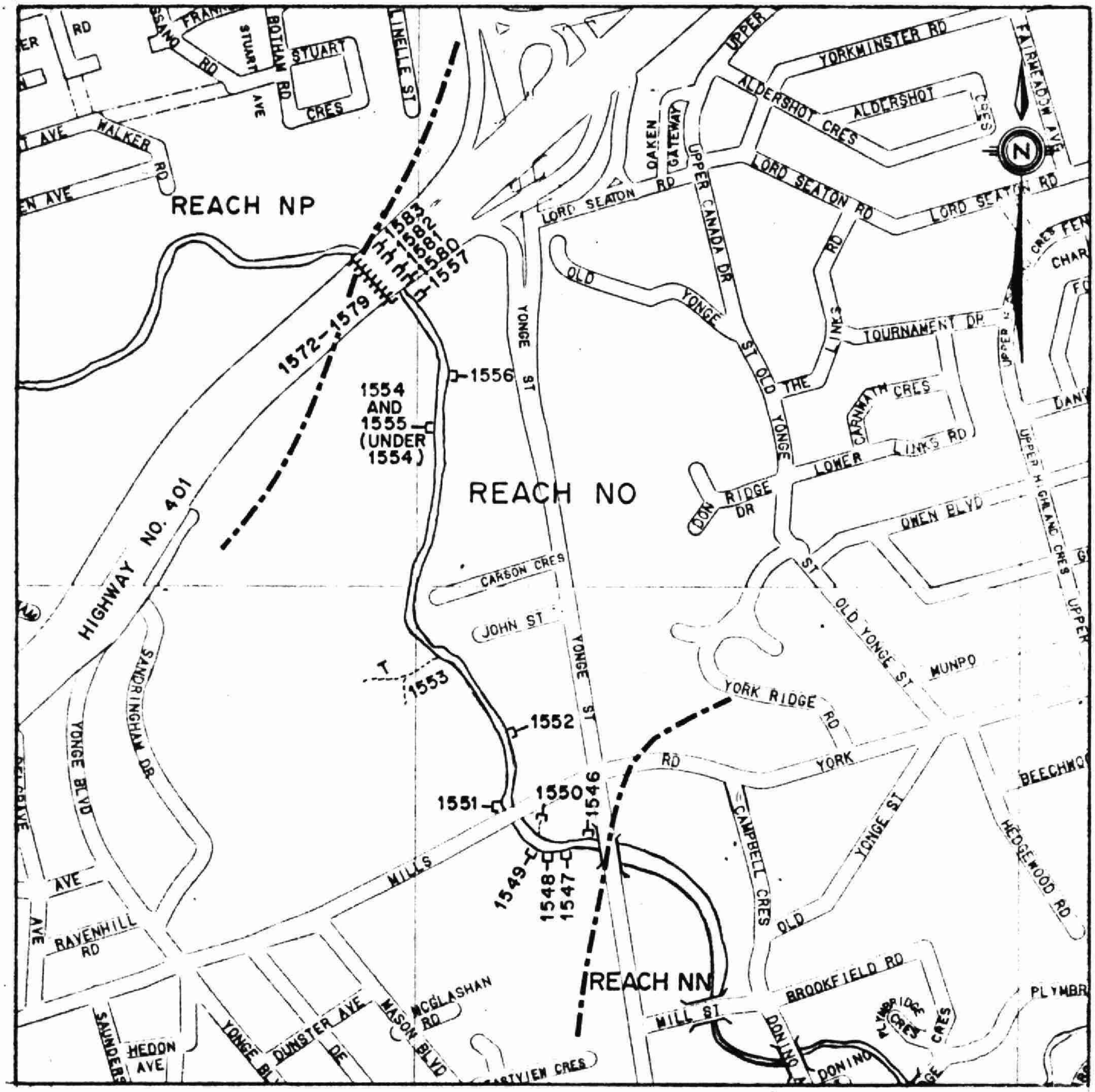
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-35. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NO



L E G E N D

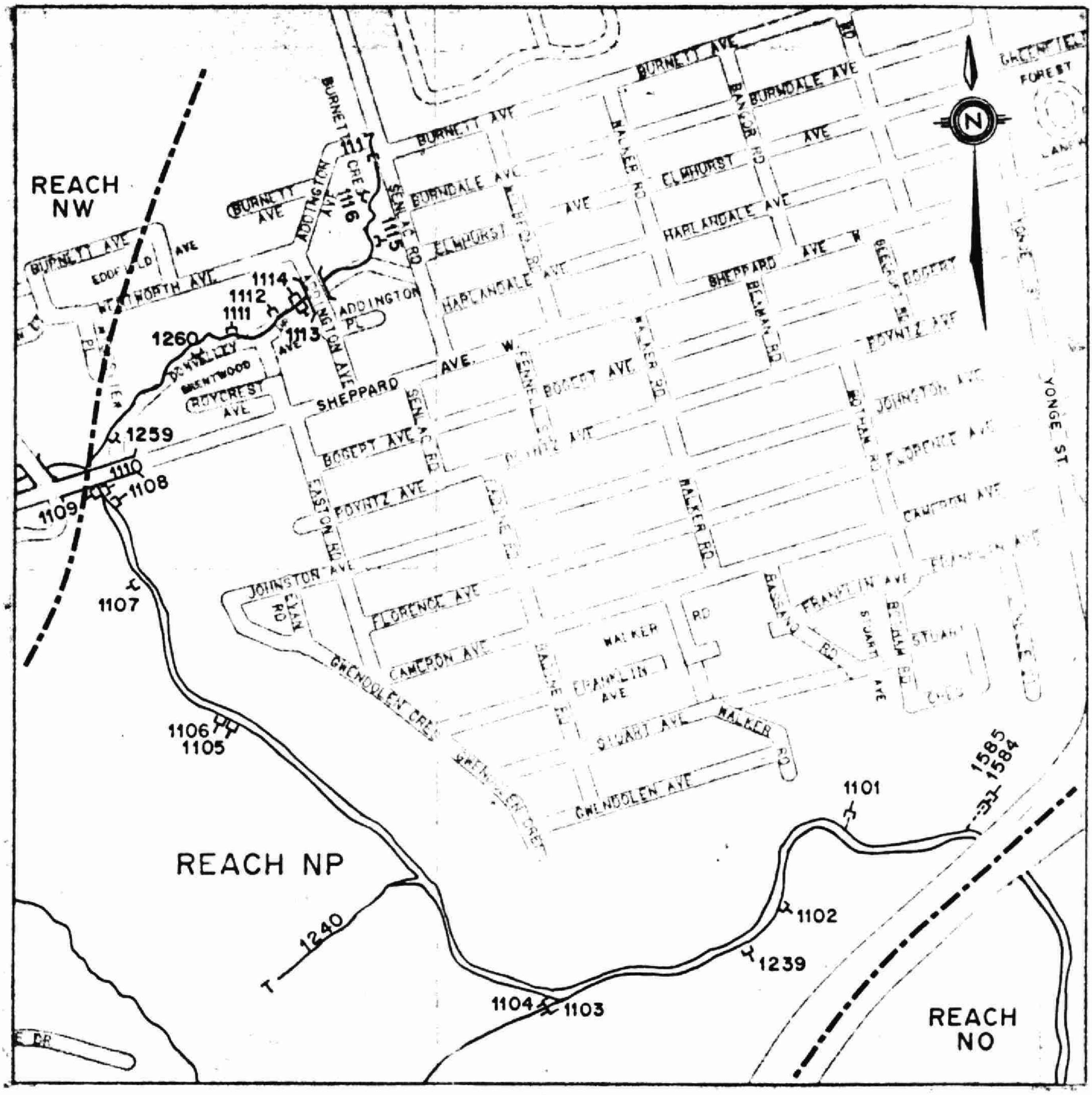
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-36. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NP



LEGEND

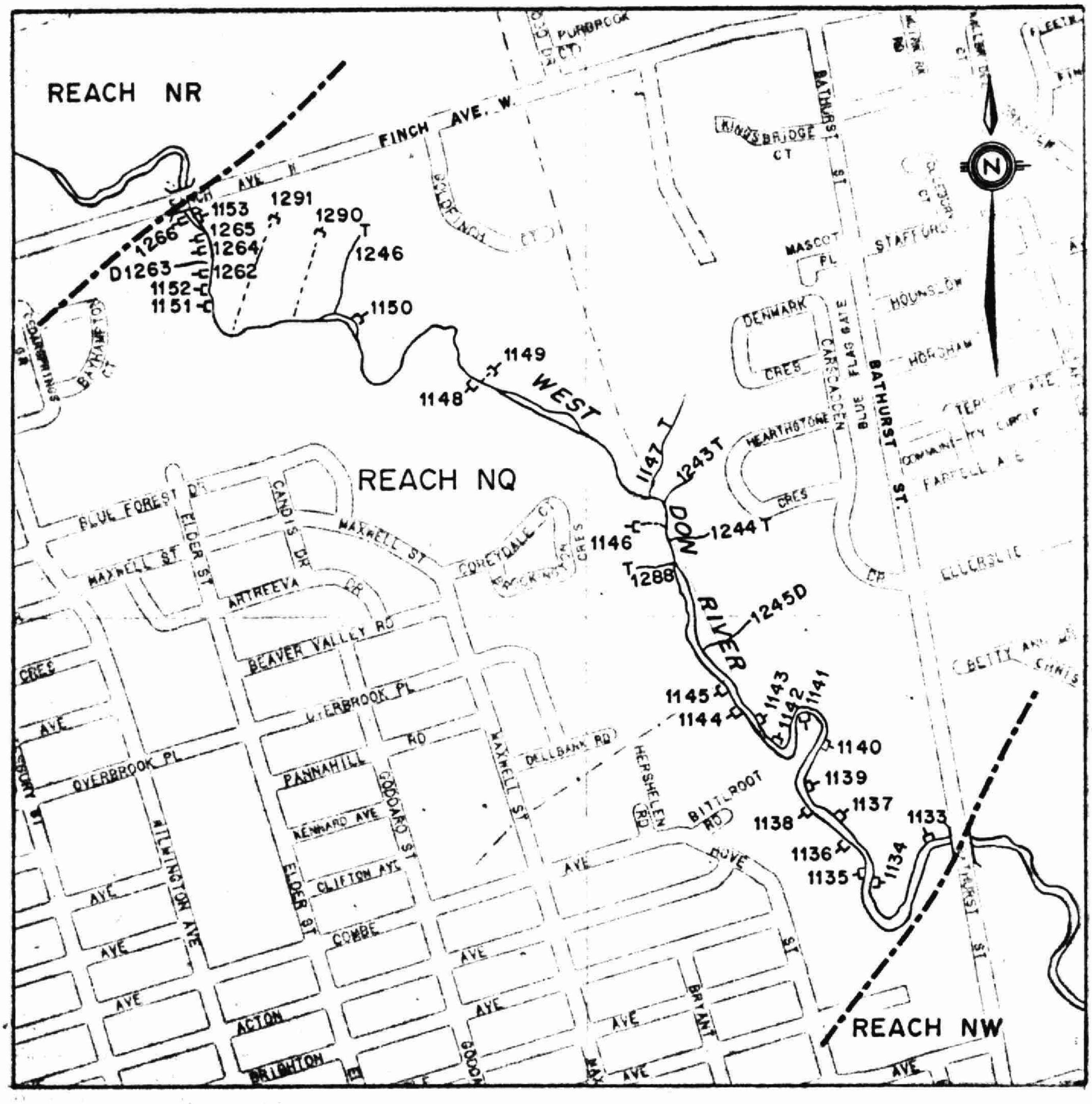
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD.

FIGURE I-37. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NQ



LEGEND

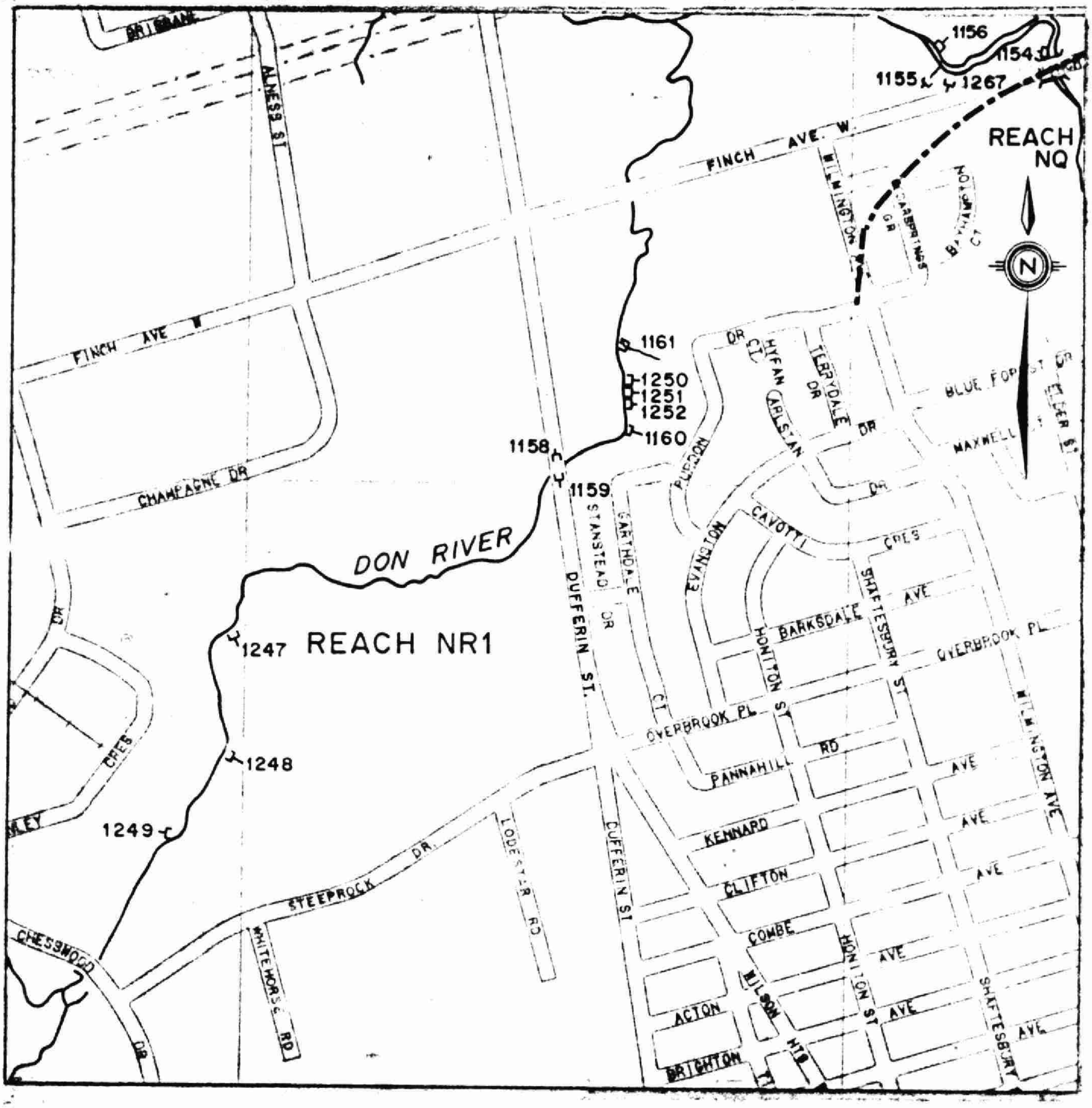
⊐— 804	OUTFALL LOCATION & IDENTIFICATION
⌒	WEIR
⟗	BRIDGE
—·—·—	REACH BOUNDARY

SCALE 1:10000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-38. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NR1



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

REACH BOUNDARY

SCALE 1:10000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-39. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NR2

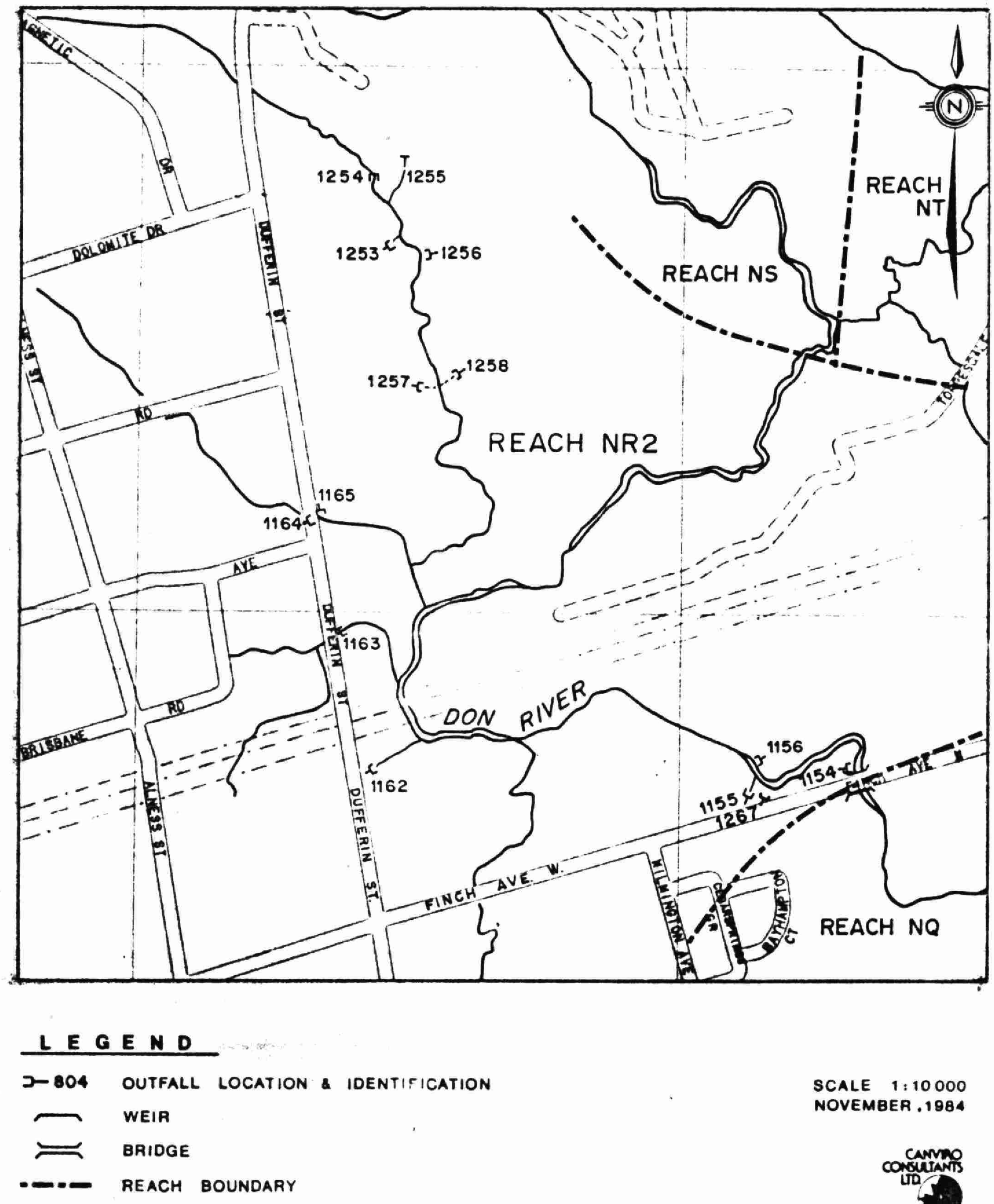
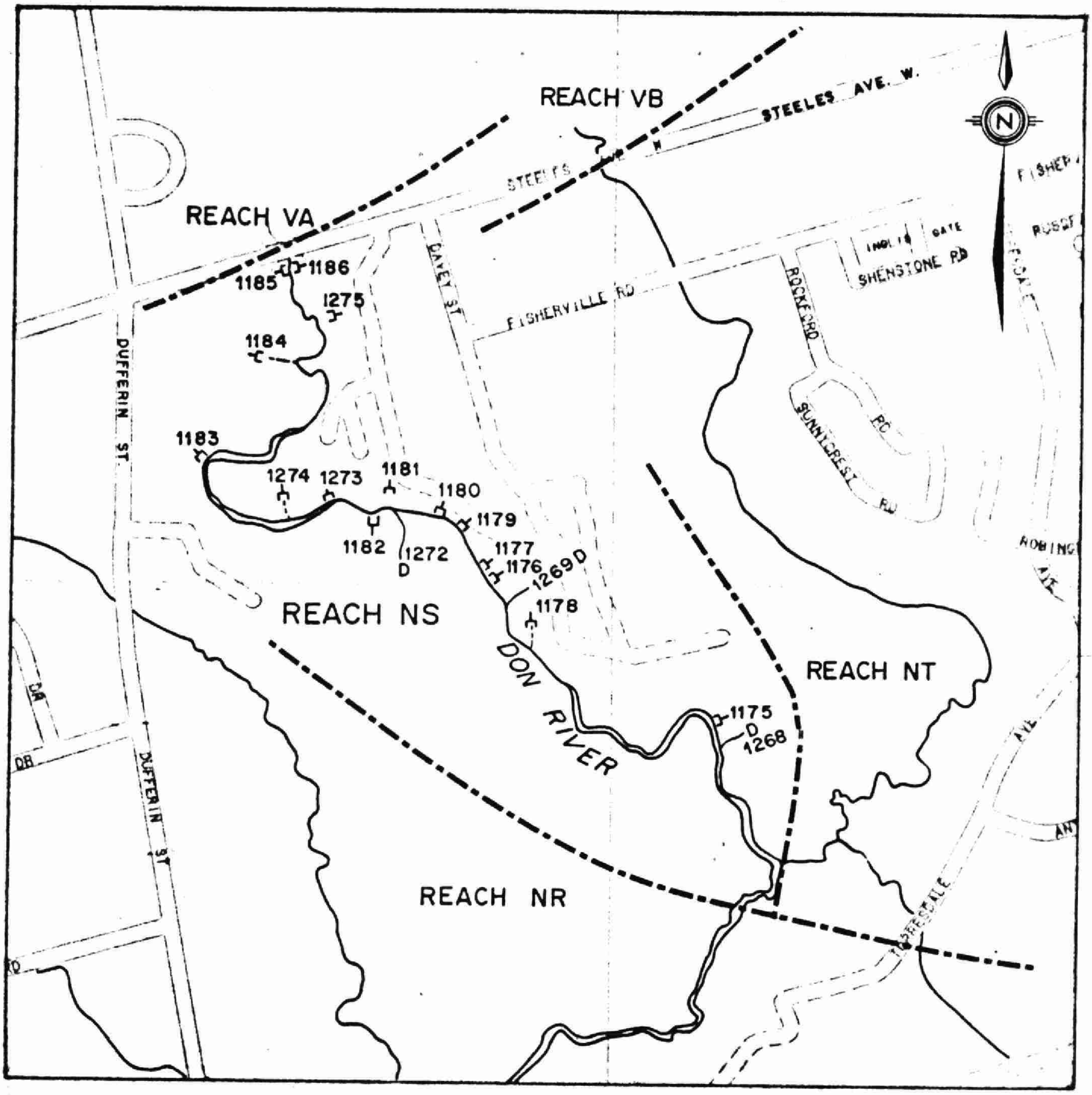


FIGURE I-40. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NS



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

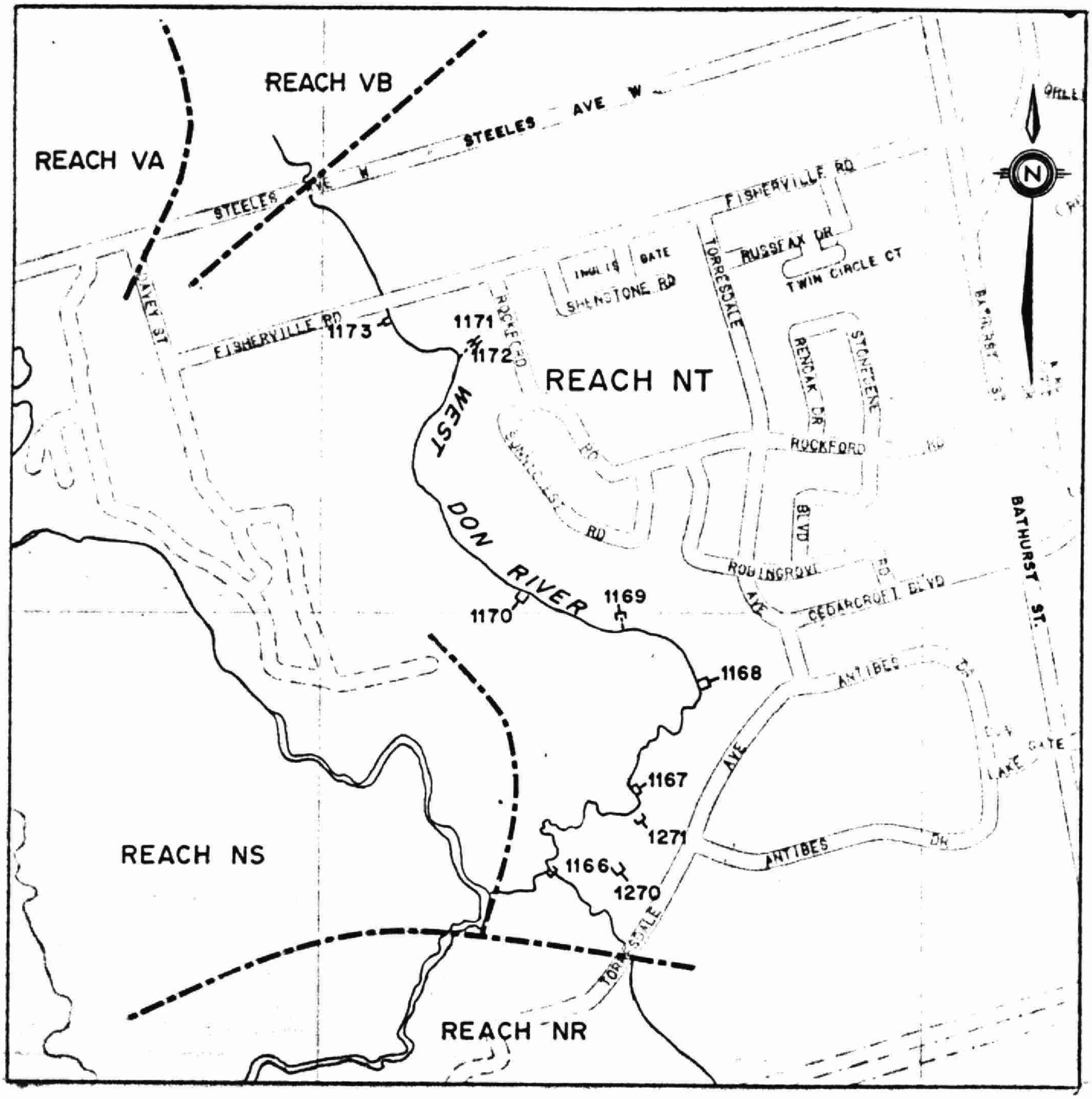
REACH BOUNDARY

SCALE 1:10000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD.

FIGURE I-41. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NT



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

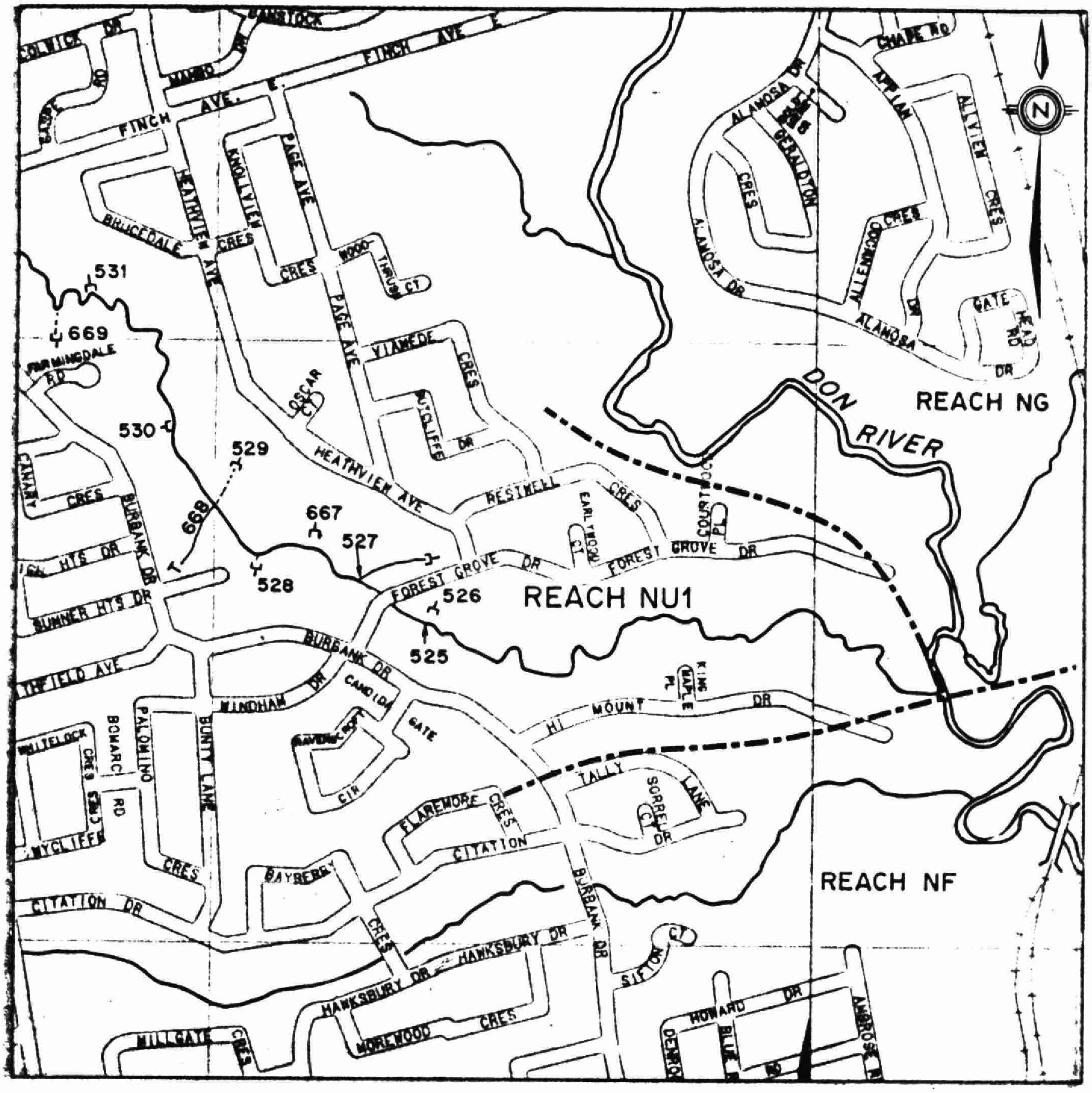
REACH BOUNDARY

SCALE 1:10000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-42. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NU1



LEGEND

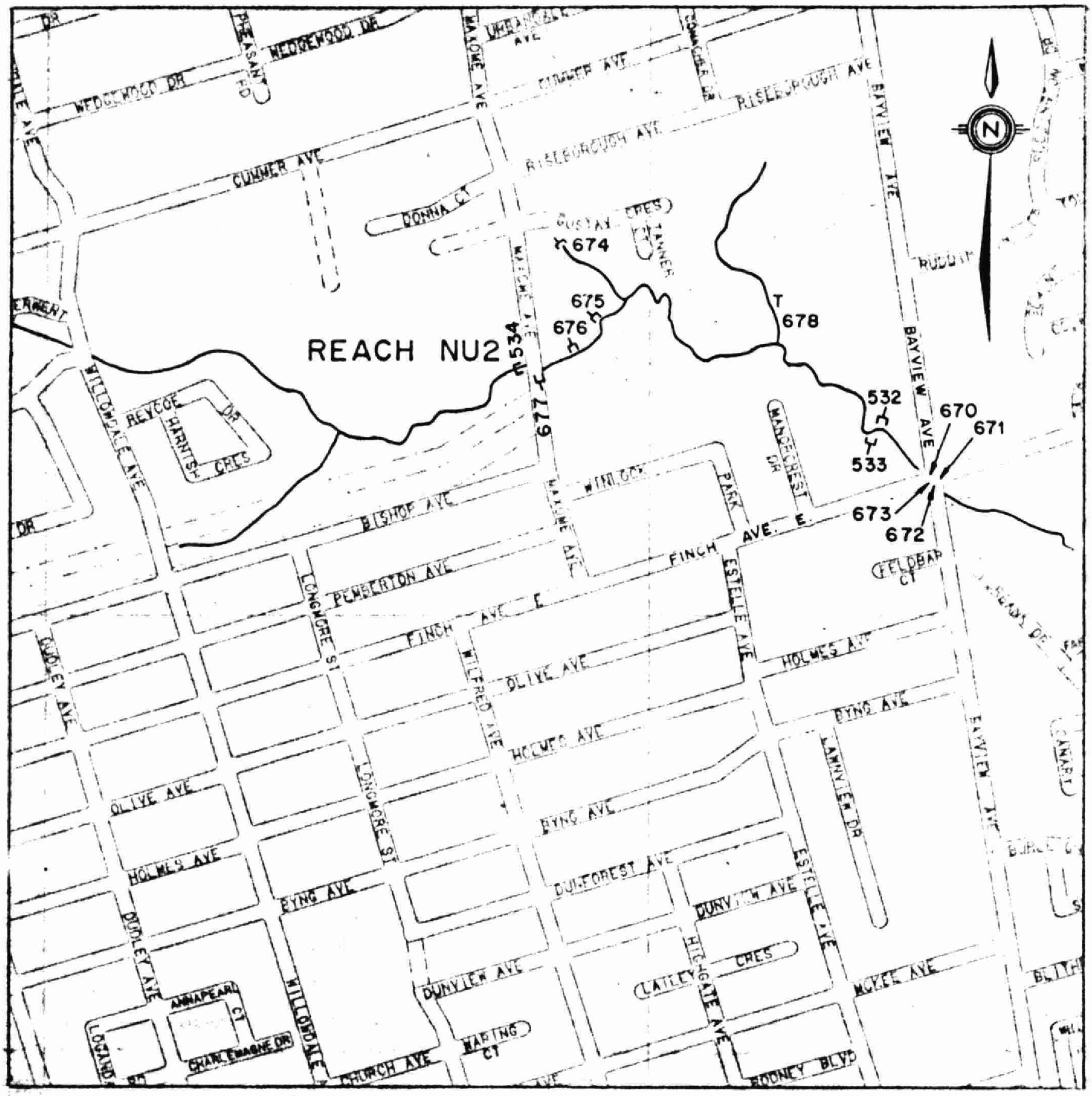
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-43. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NU2



L E G E N D

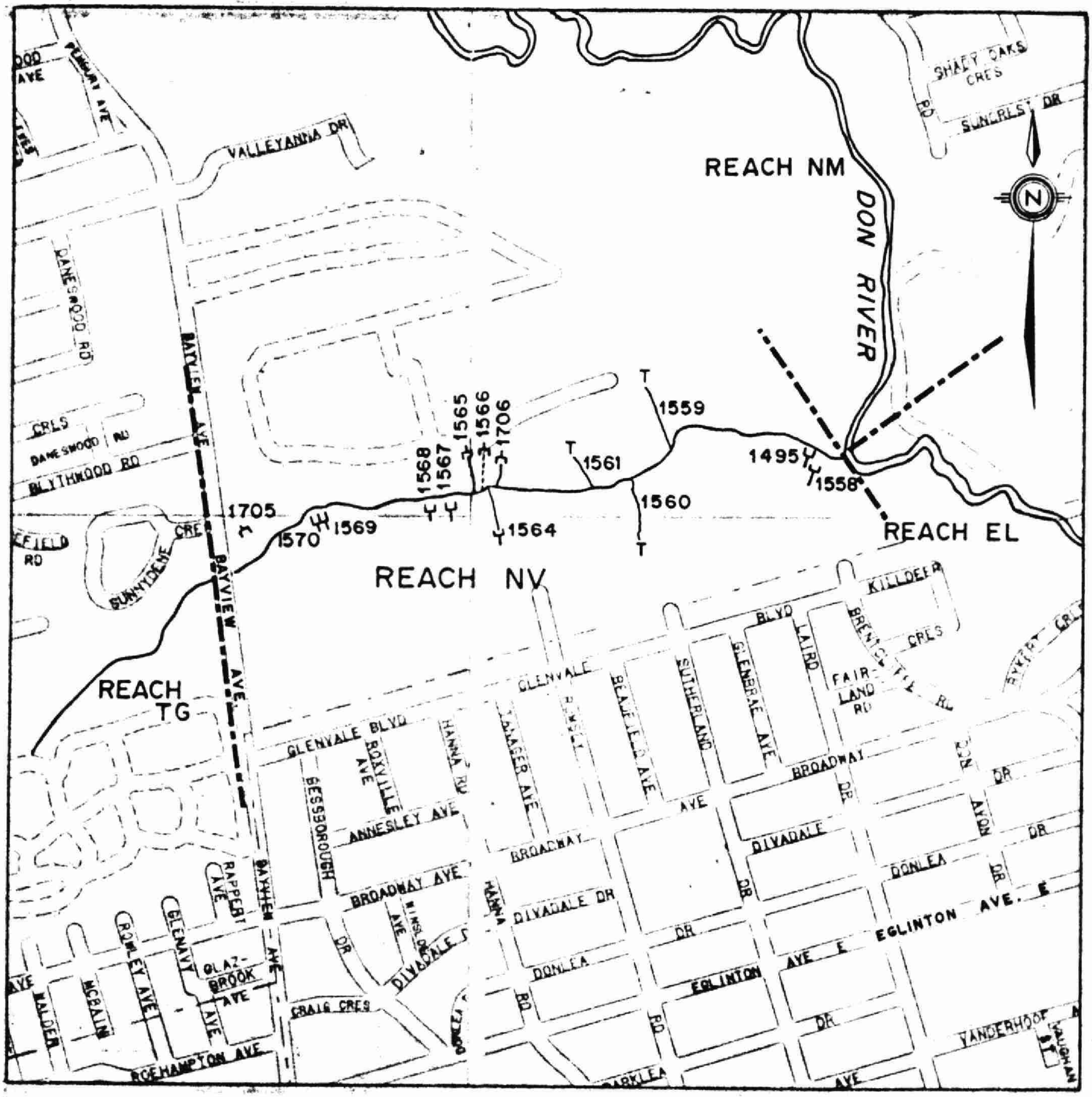
⊃— 804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
▬ ▪ ▬	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-44. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NV



LEGEND

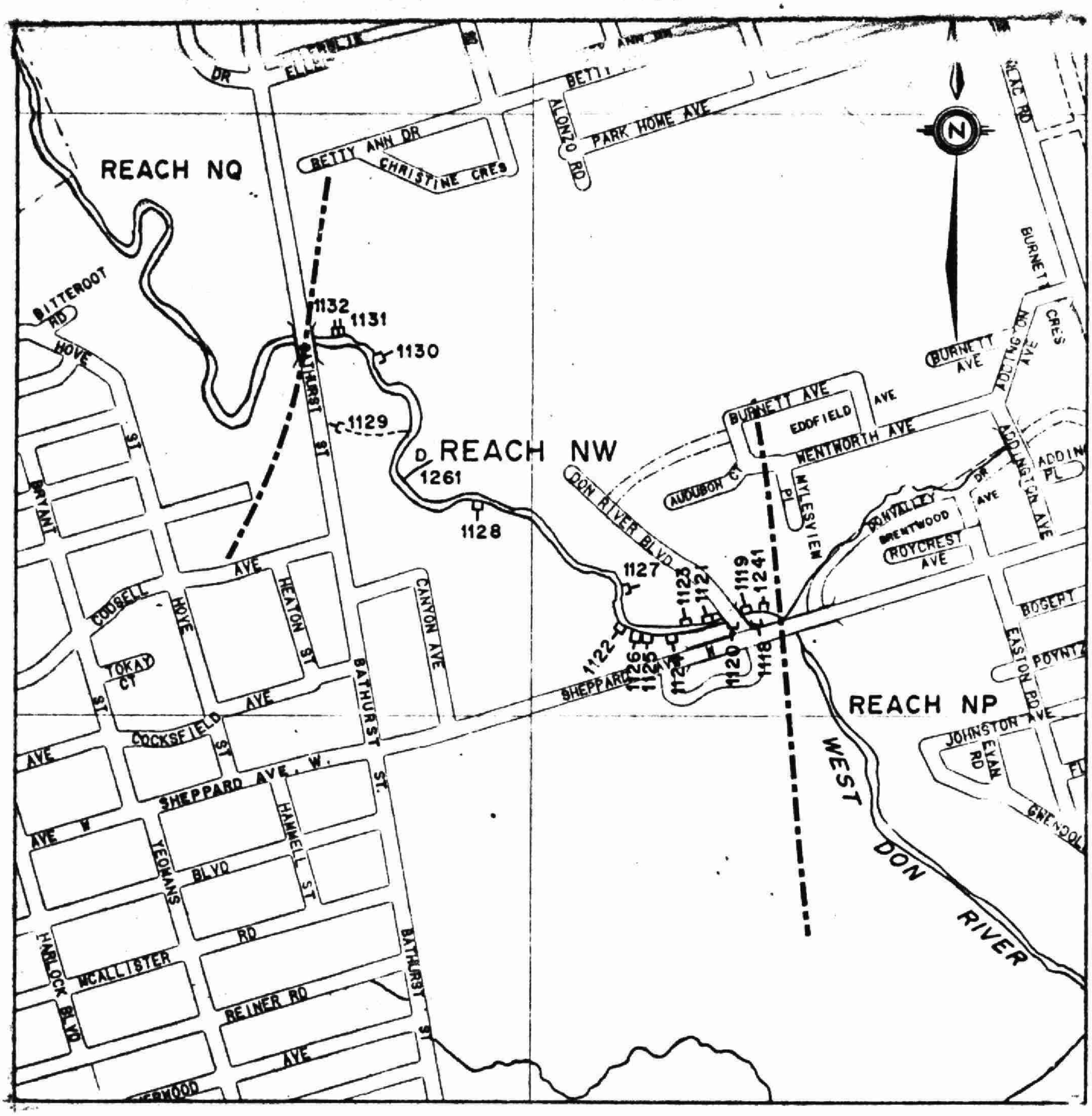
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-45. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NW



L E G E N D

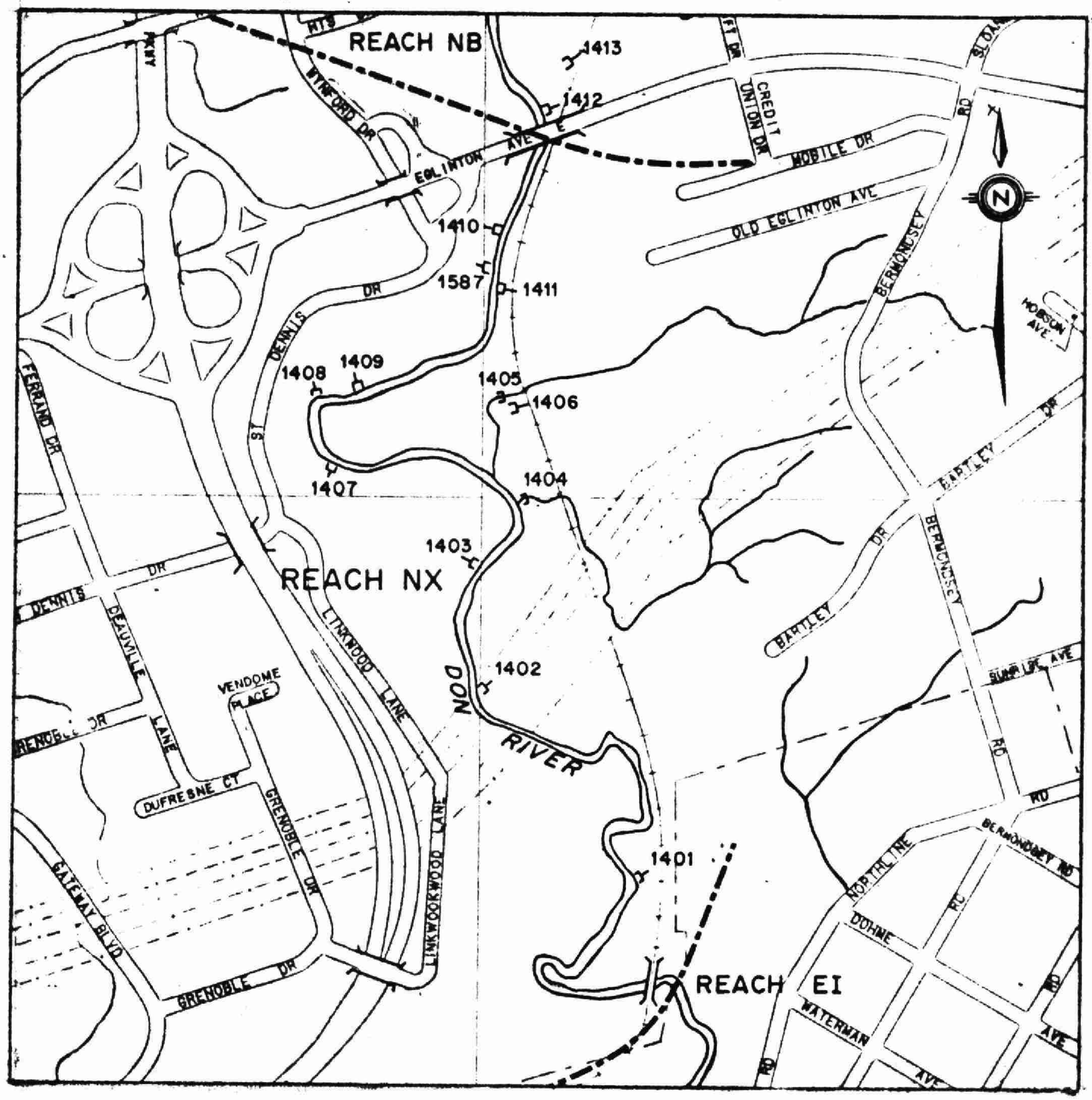
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-46. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NX



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

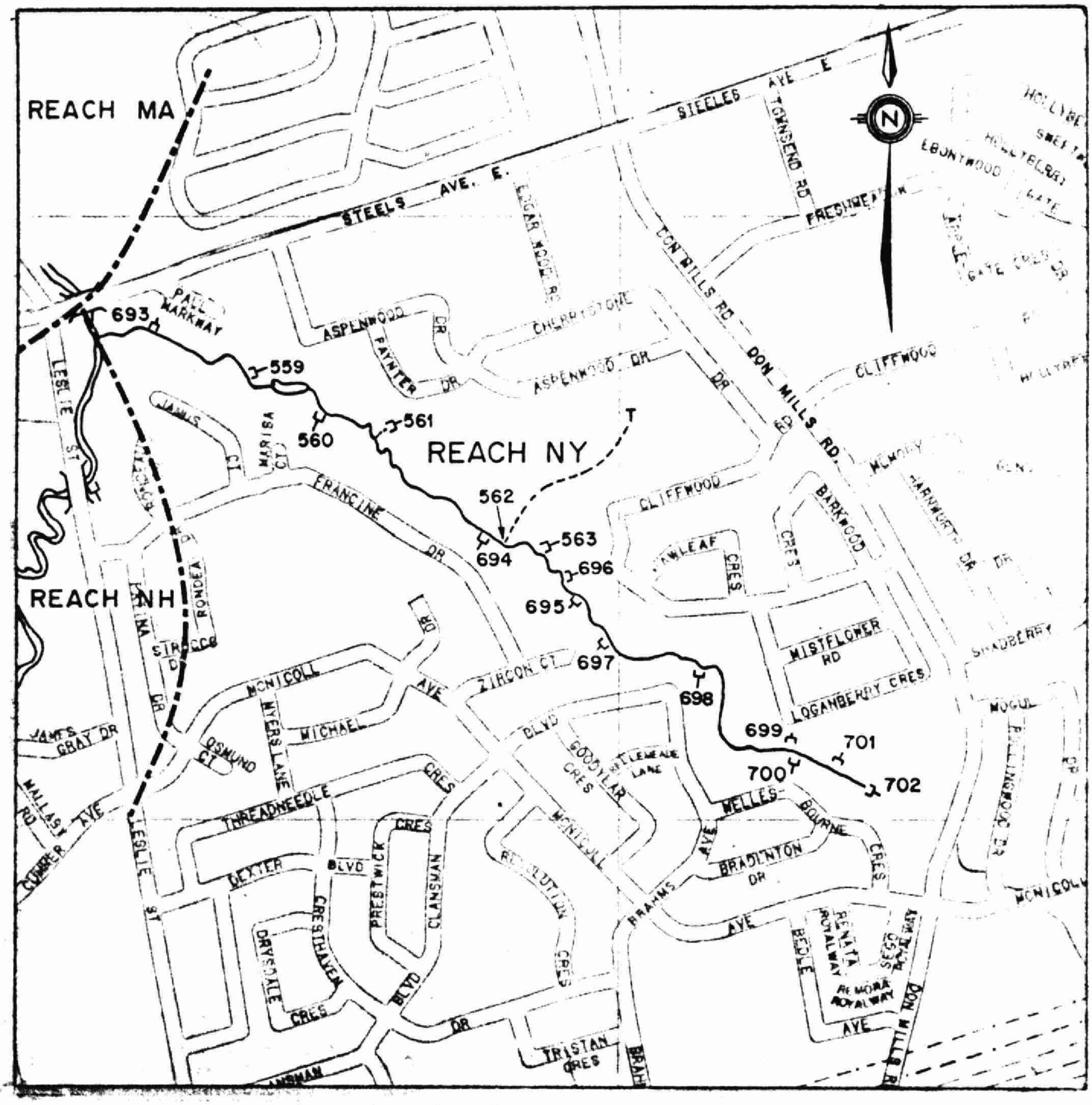
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-47. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH NY



LEGEND

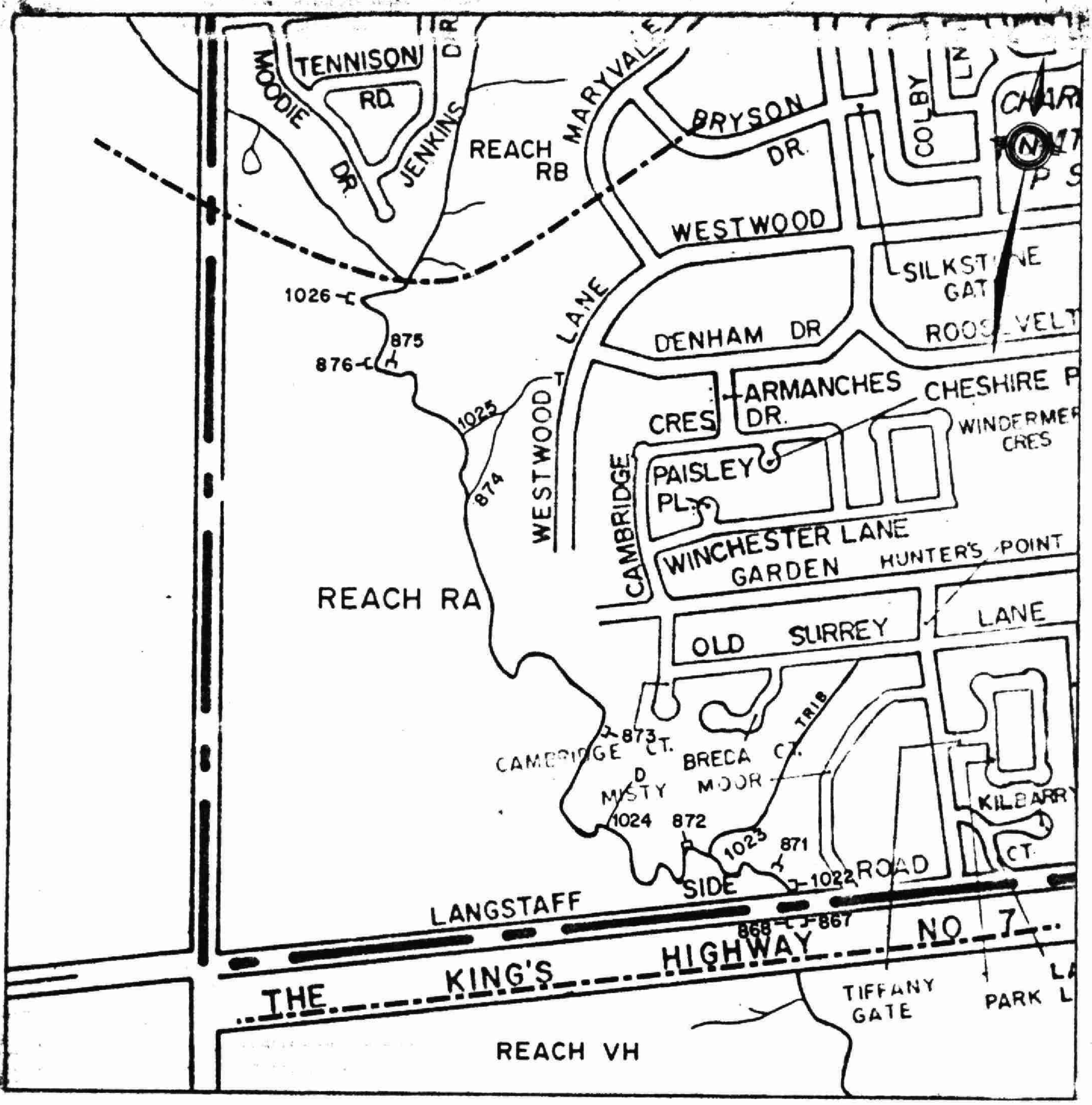
- 804 — OUTFALL LOCATION & IDENTIFICATION
- WEIR
- BRIDGE
- REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-48. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH RA



LEGEND

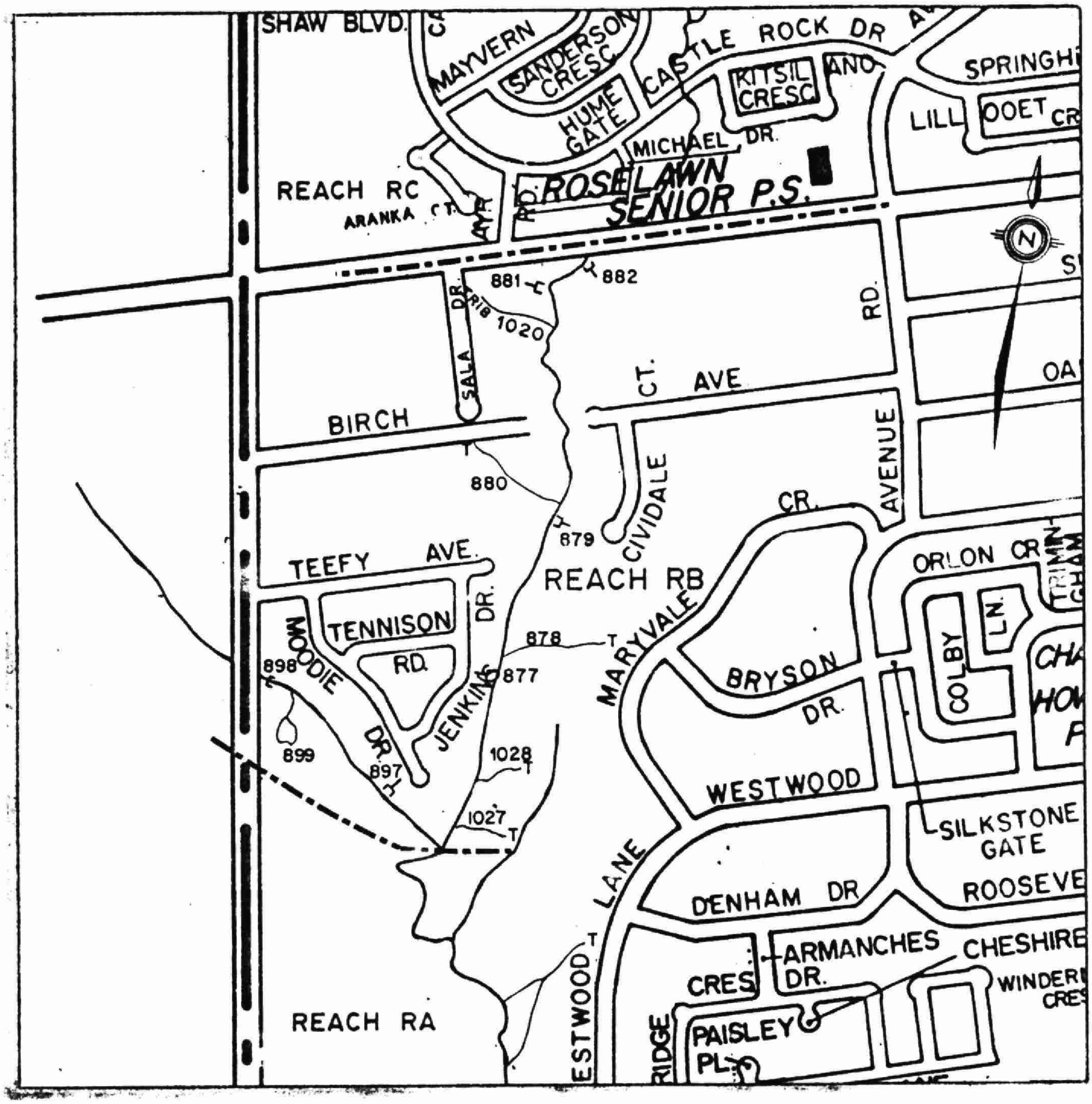
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-49. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH RB



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

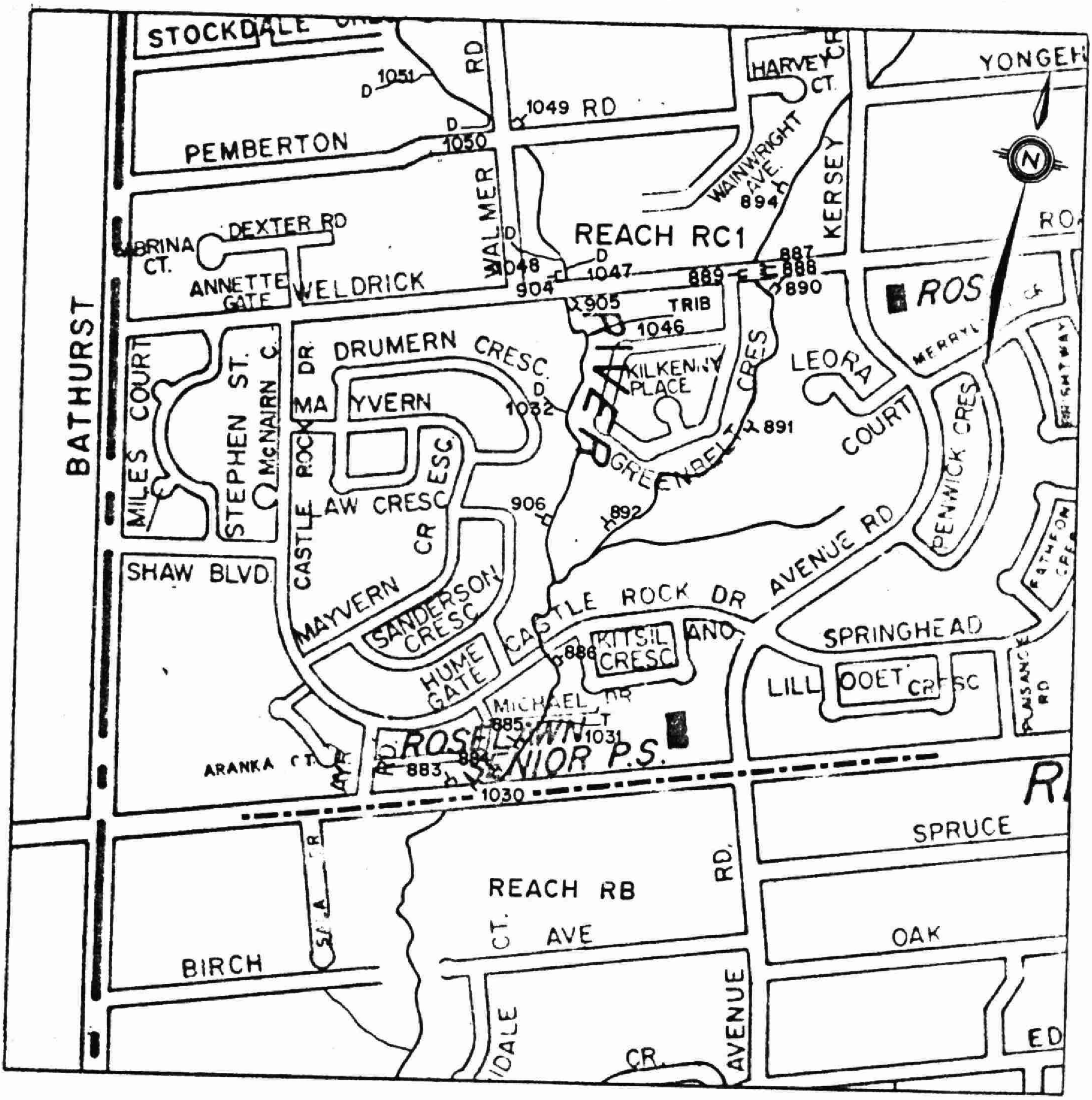
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-50. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH RC1



LEGEND

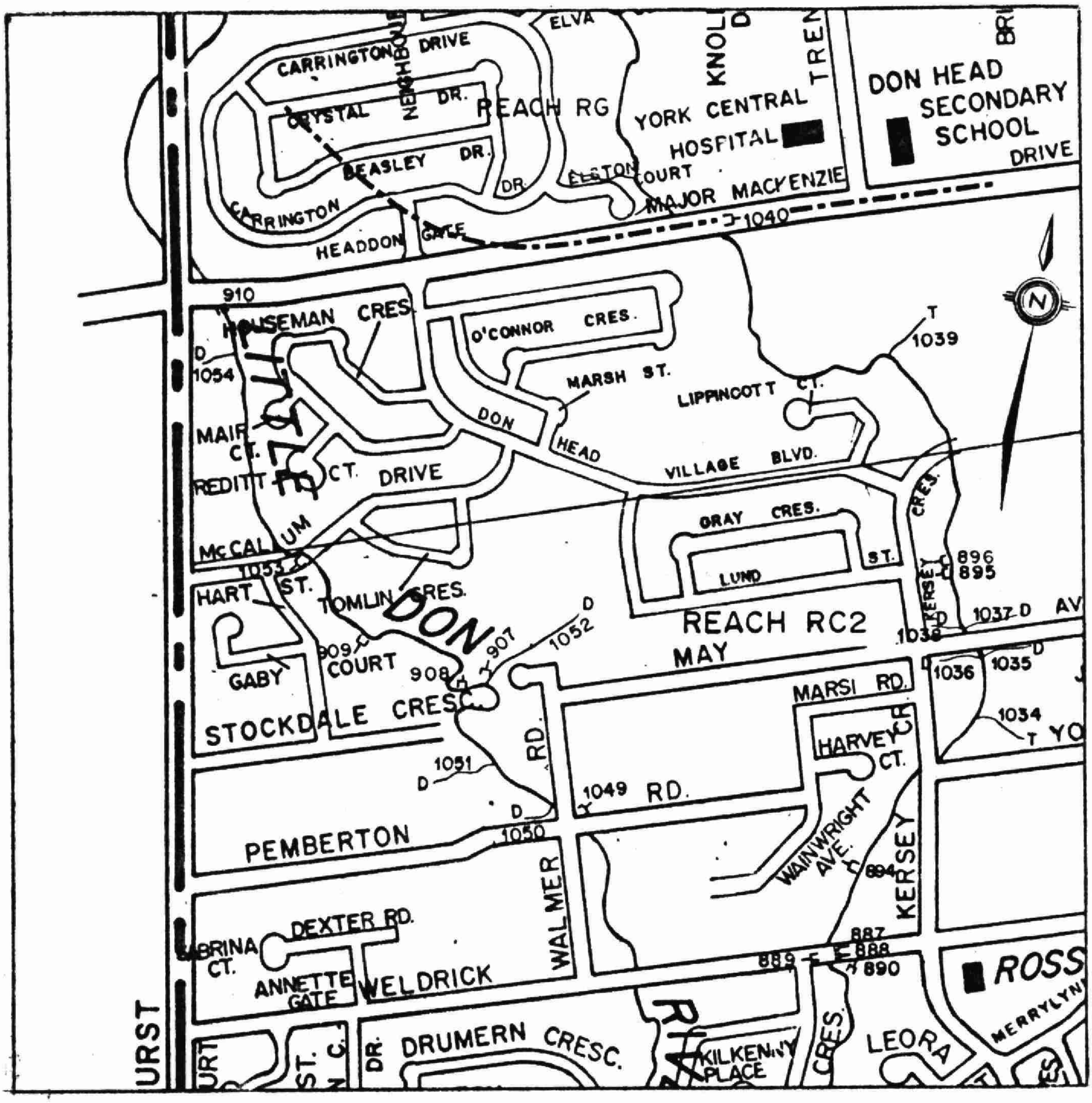
- 804 OUTFALL LOCATION & IDENTIFICATION
- WEIR
- BRIDGE
- REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-51. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH RC2



LEGEND

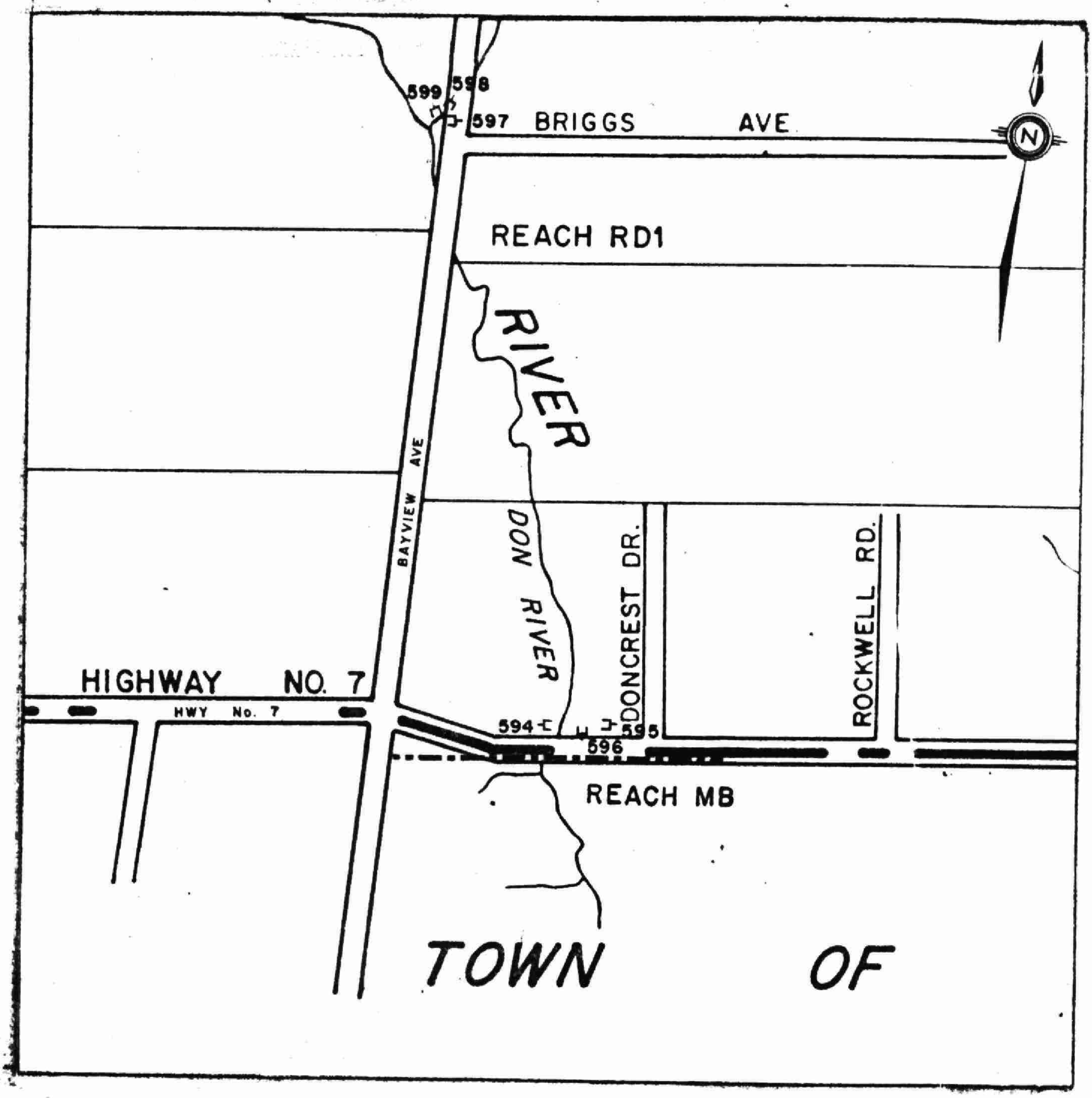
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-52. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH RD1



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

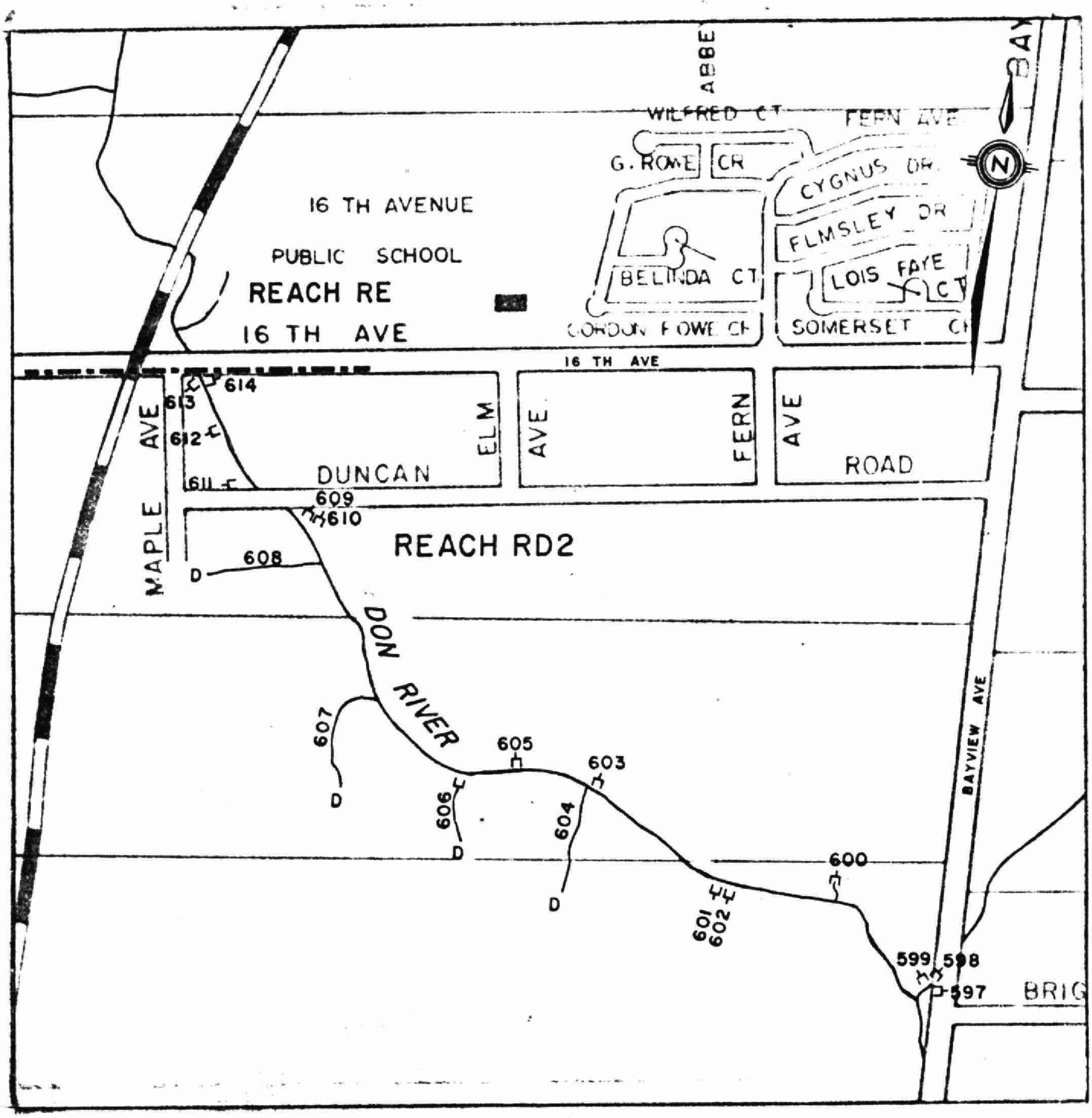
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-53. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH RD2



LEGEND

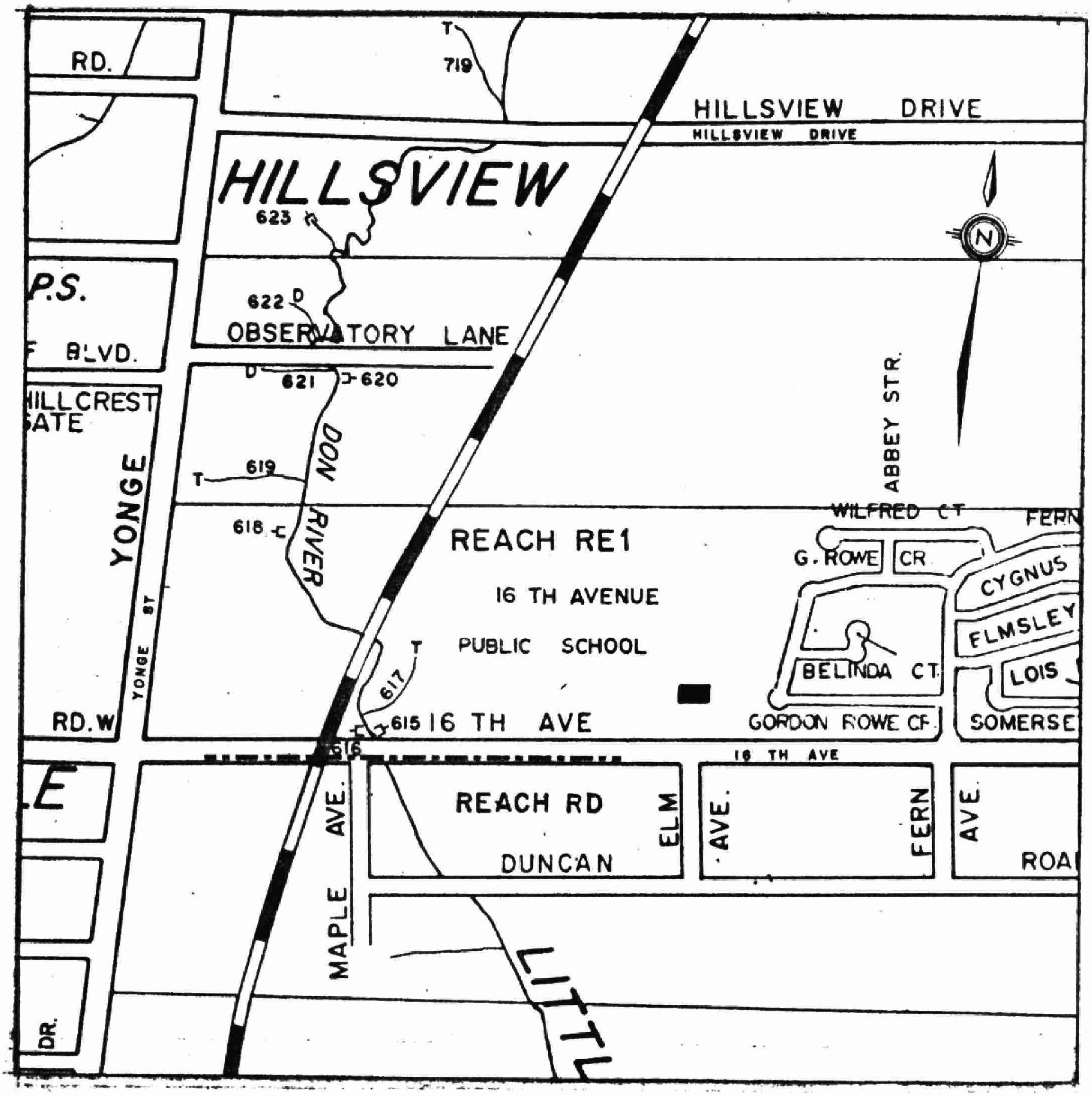
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD.

FIGURE I-54. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH RE1



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

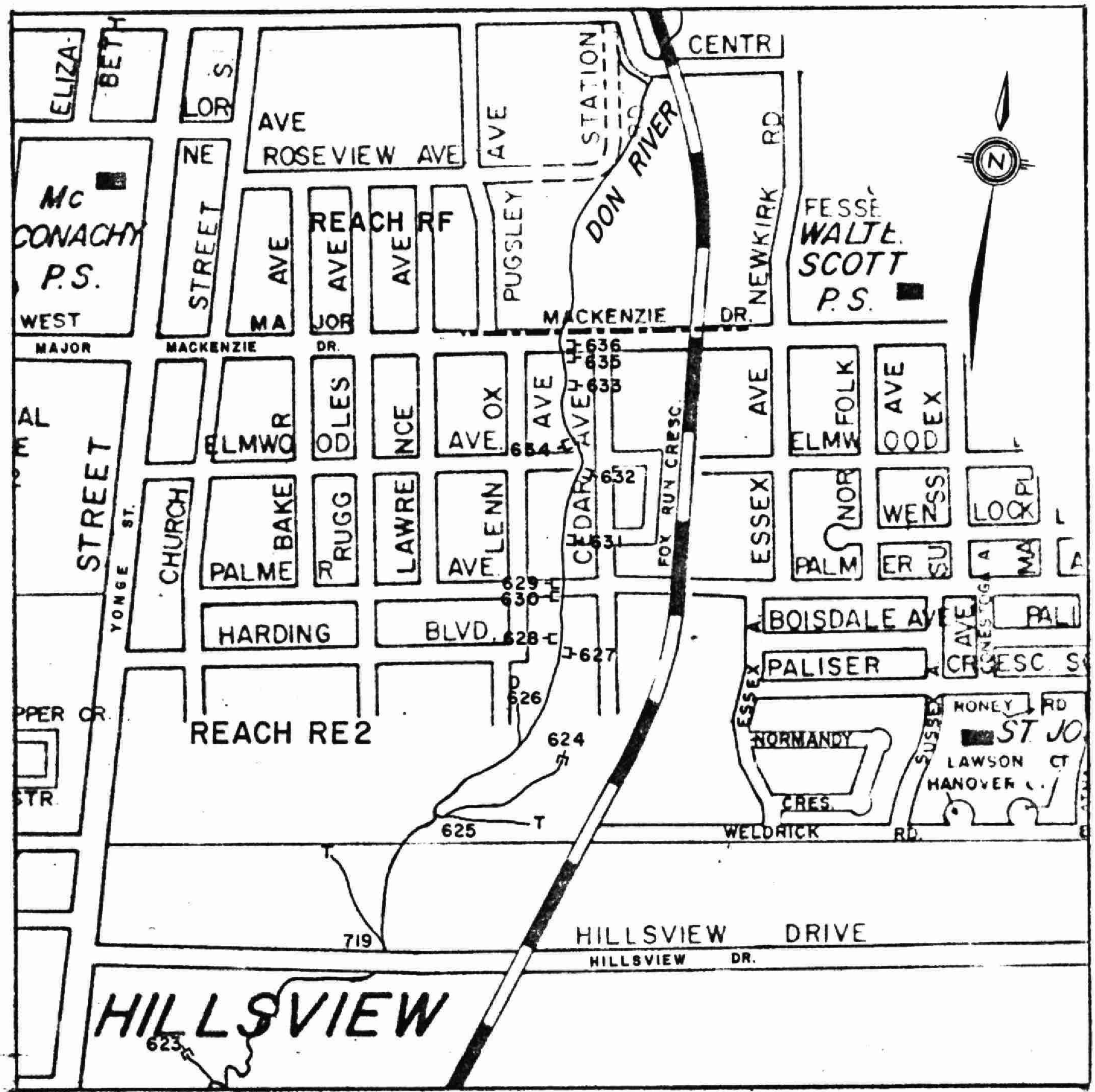
REACH BOUNDARY

SCALE 1:10000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD.

FIGURE I-55. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH RE2



LEGEND

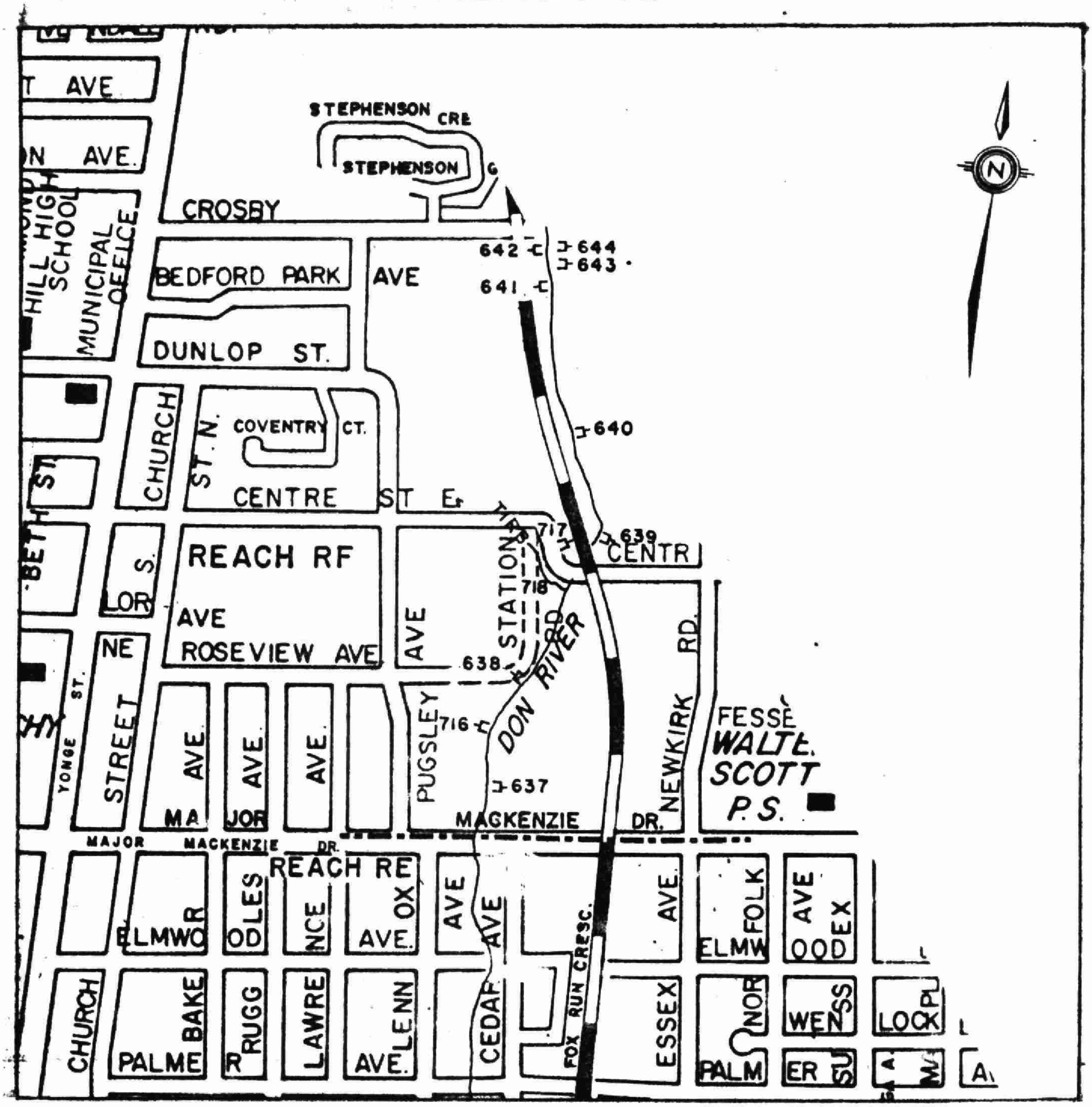
- 804 OUTFALL LOCATION & IDENTIFICATION
- WEIR
- BRIDGE
- REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-56. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH RF



LEGEND

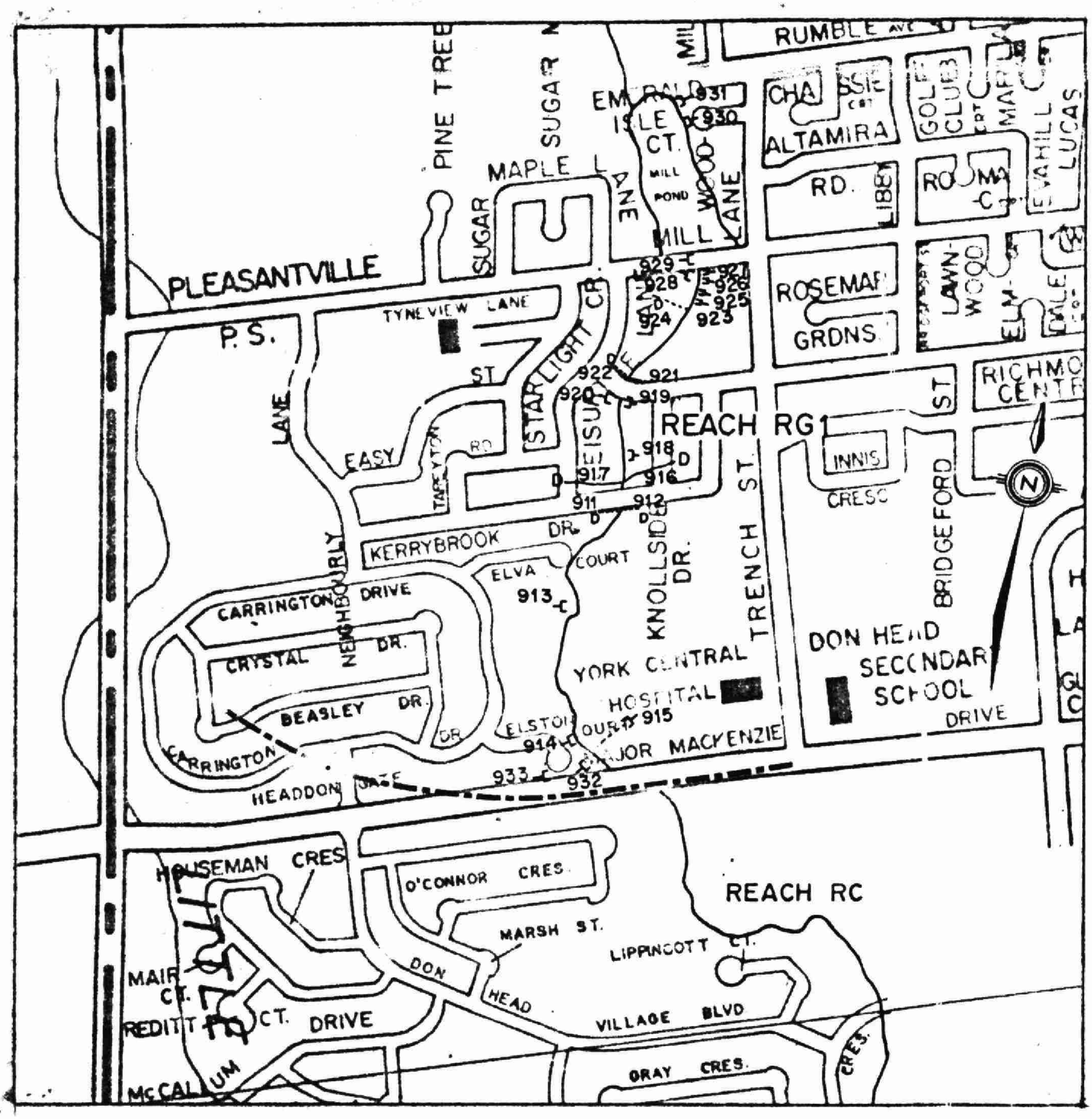
- 804 OUTFALL LOCATION & IDENTIFICATION
- WEIR
- BRIDGE
- REACH BOUNDARY

SCALE 1:10000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-57. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH RG1



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

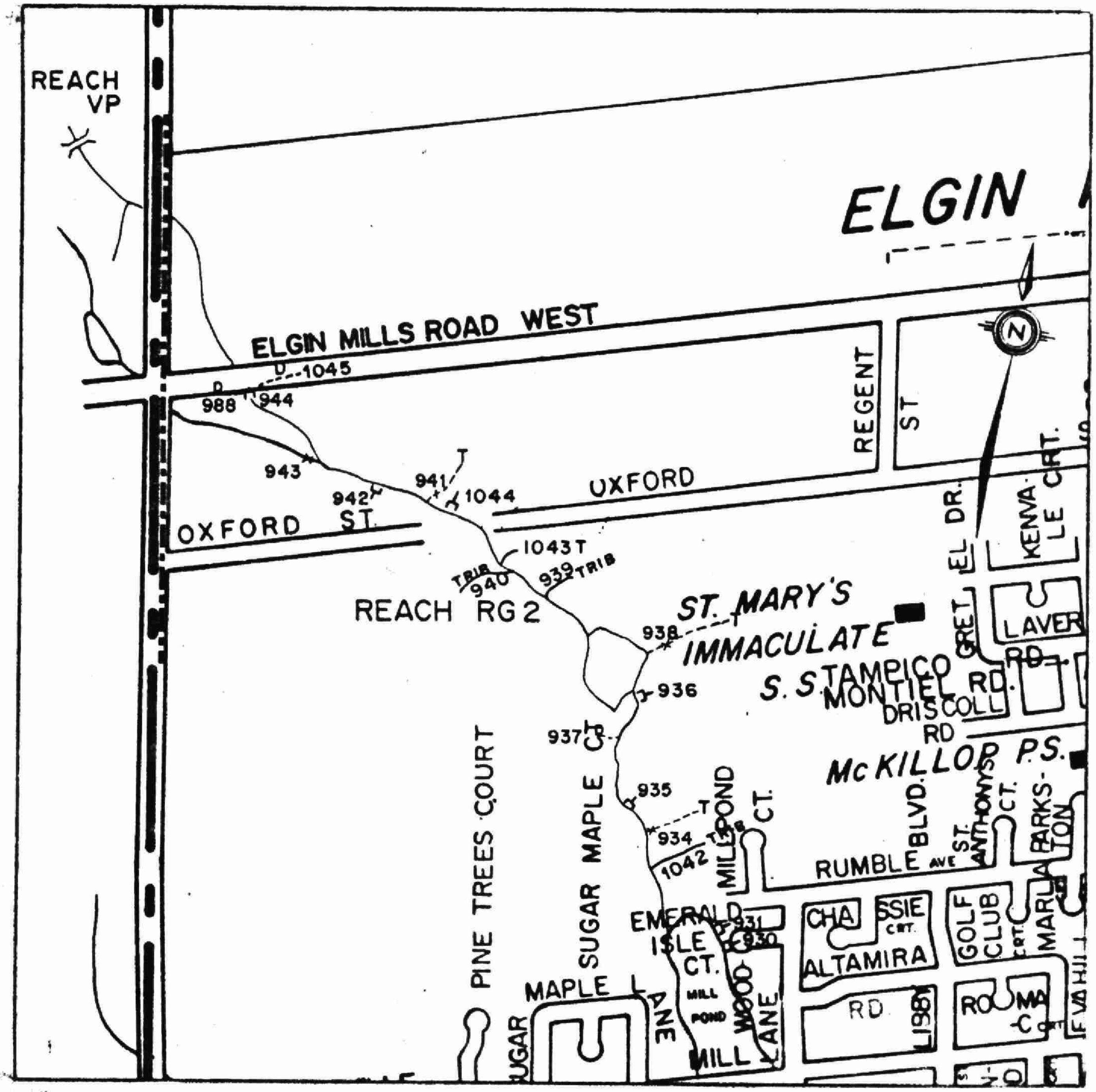
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-58. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH RG2



LEGEND

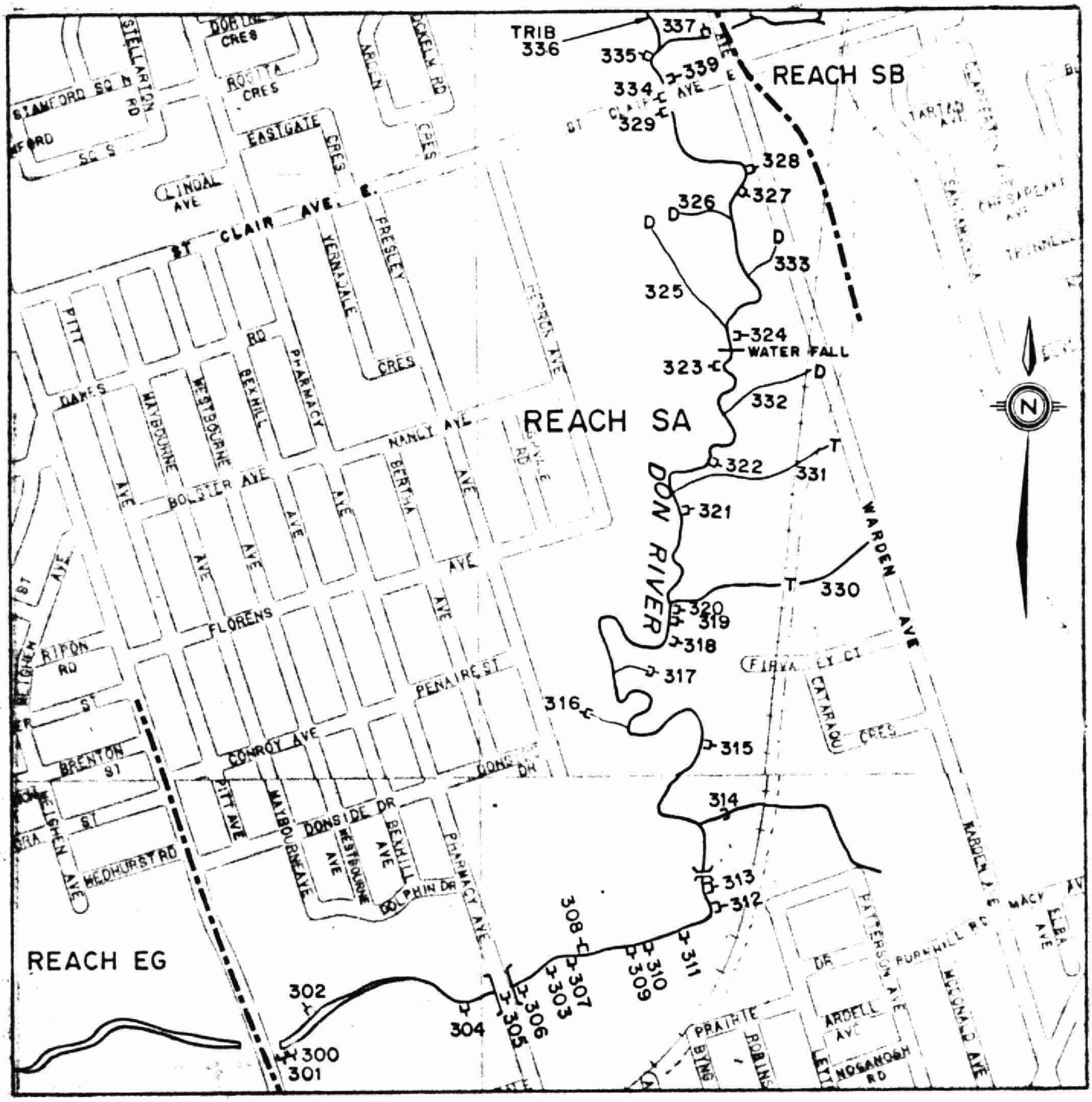
⊐— 804	OUTFALL LOCATION & IDENTIFICATION
⌒	WEIR
⌒⌣	BRIDGE
▬ ▪ ▬	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER ,1984

CANVIRO CONSULTANTS LTD

FIGURE I-59. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH SA



LEGEND

804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-60. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH SB1

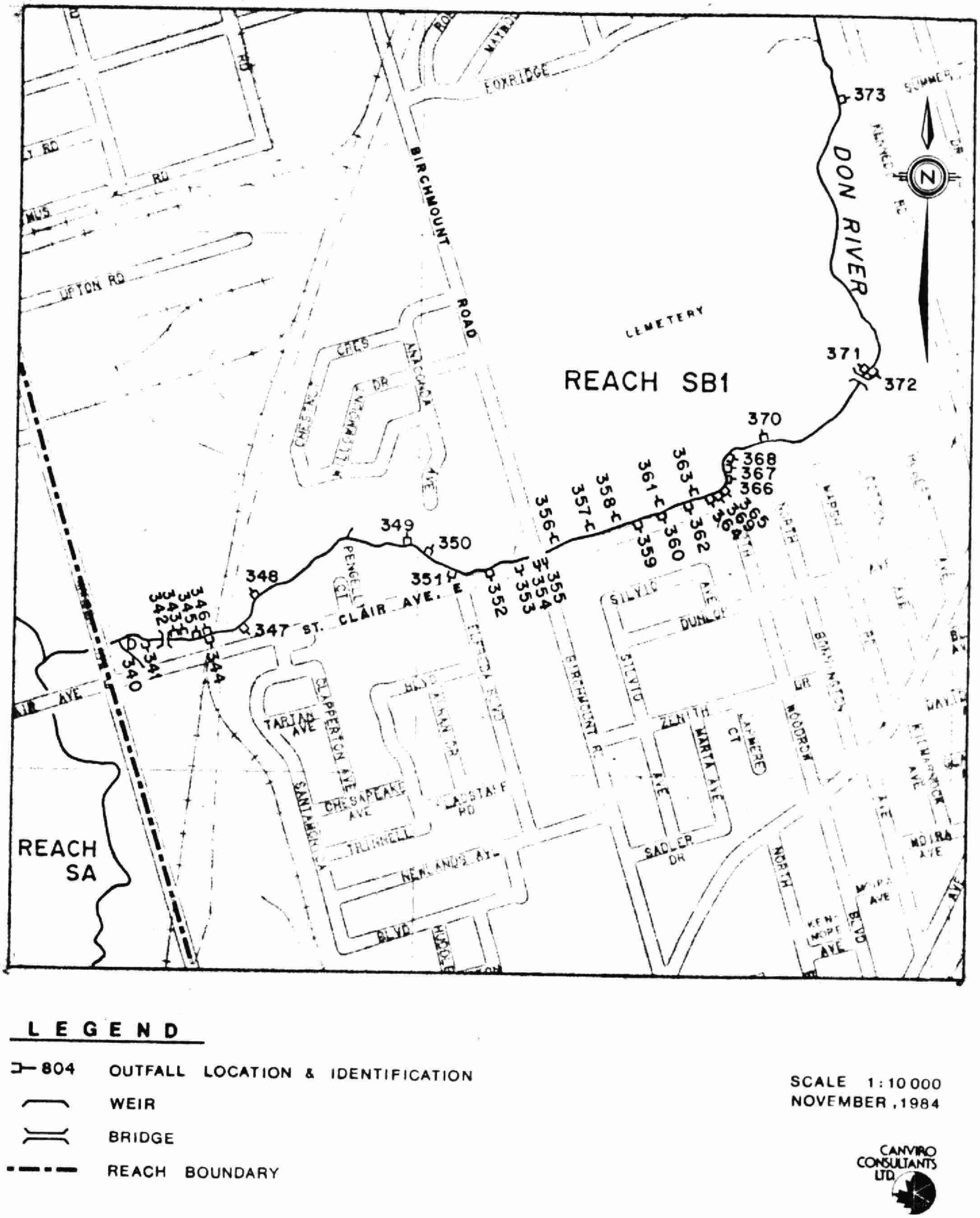
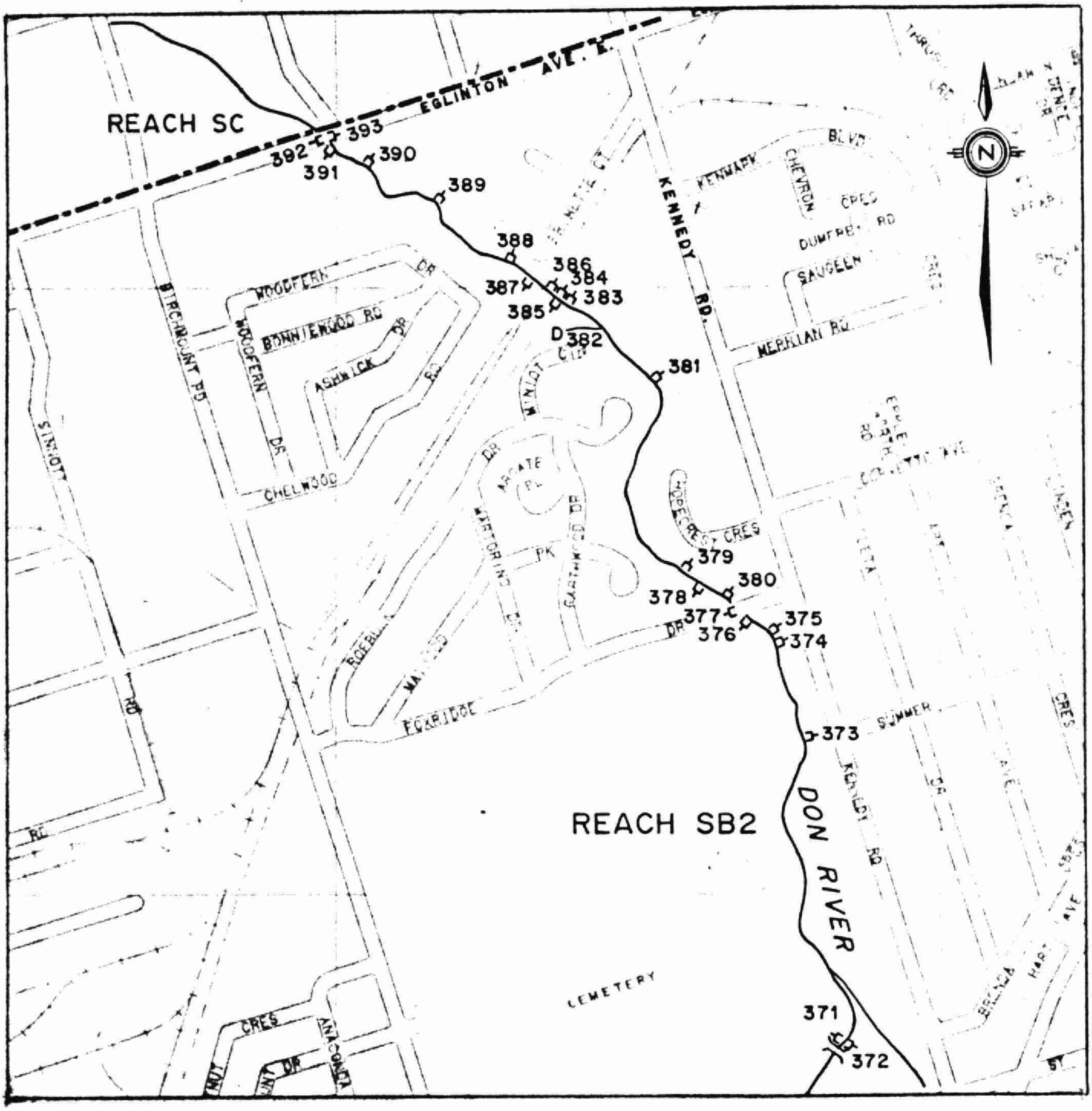


FIGURE I-61. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH SB2



LEGEND

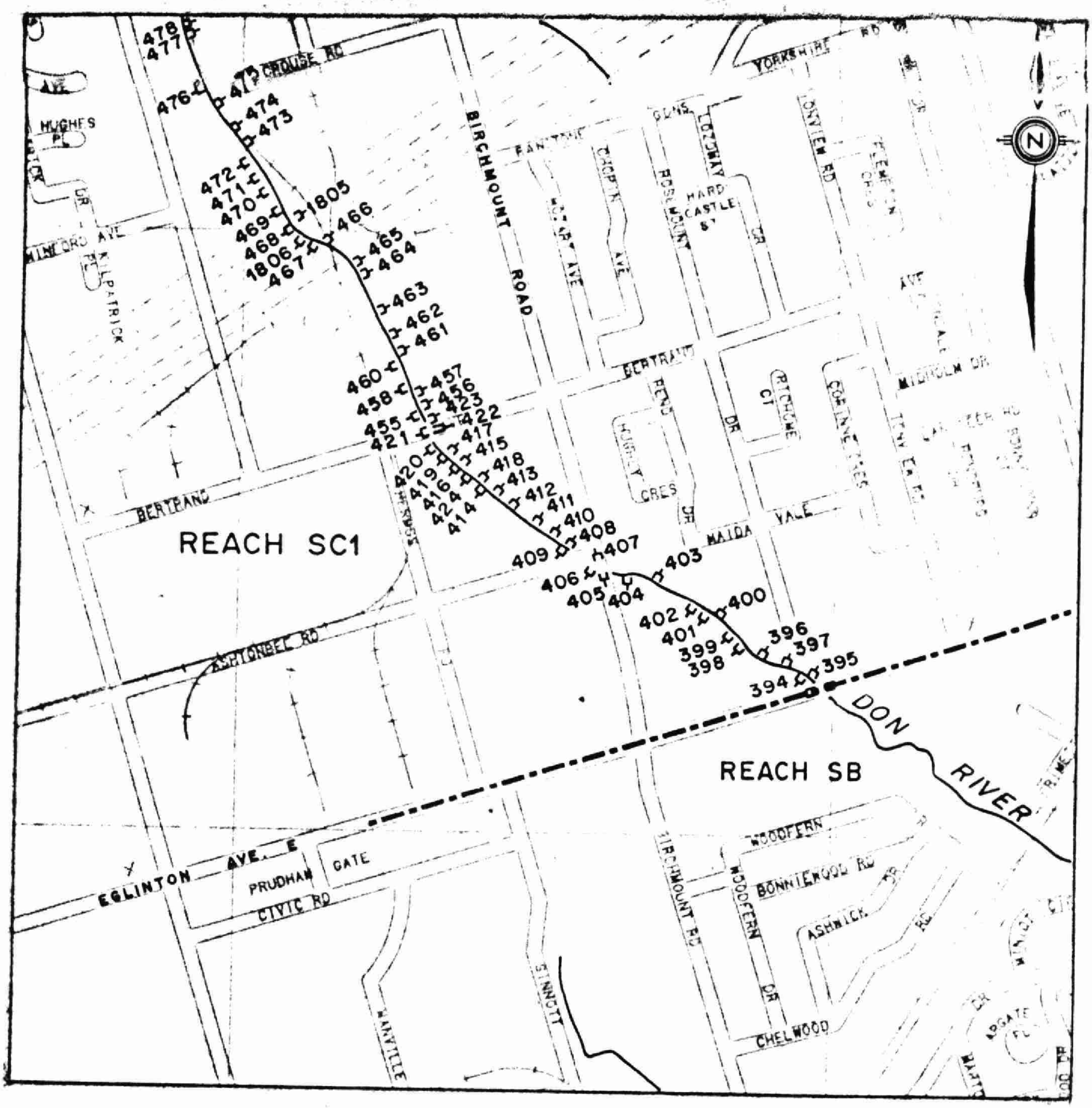
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-62. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH SC1



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

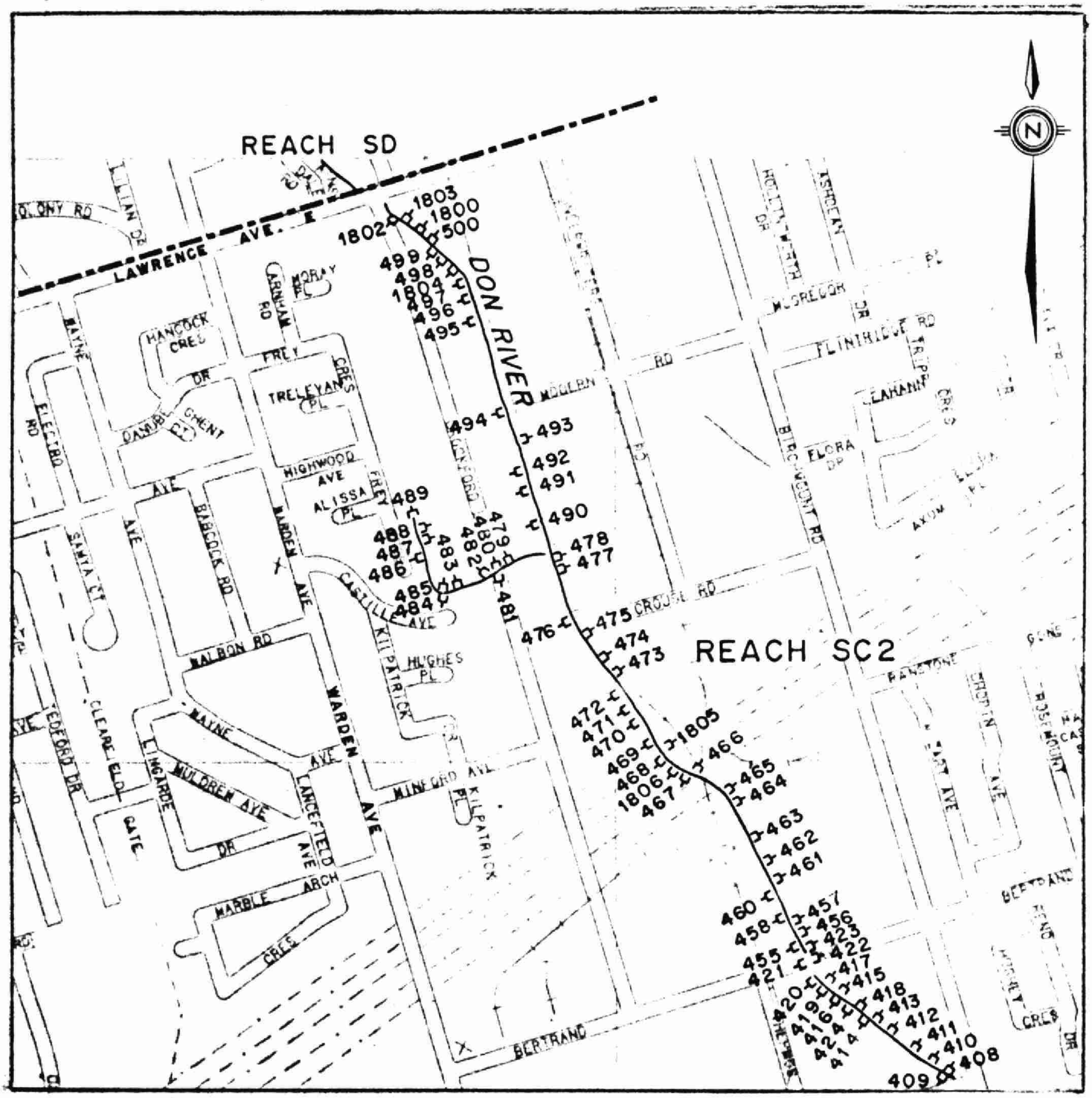
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-63. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH SC2



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

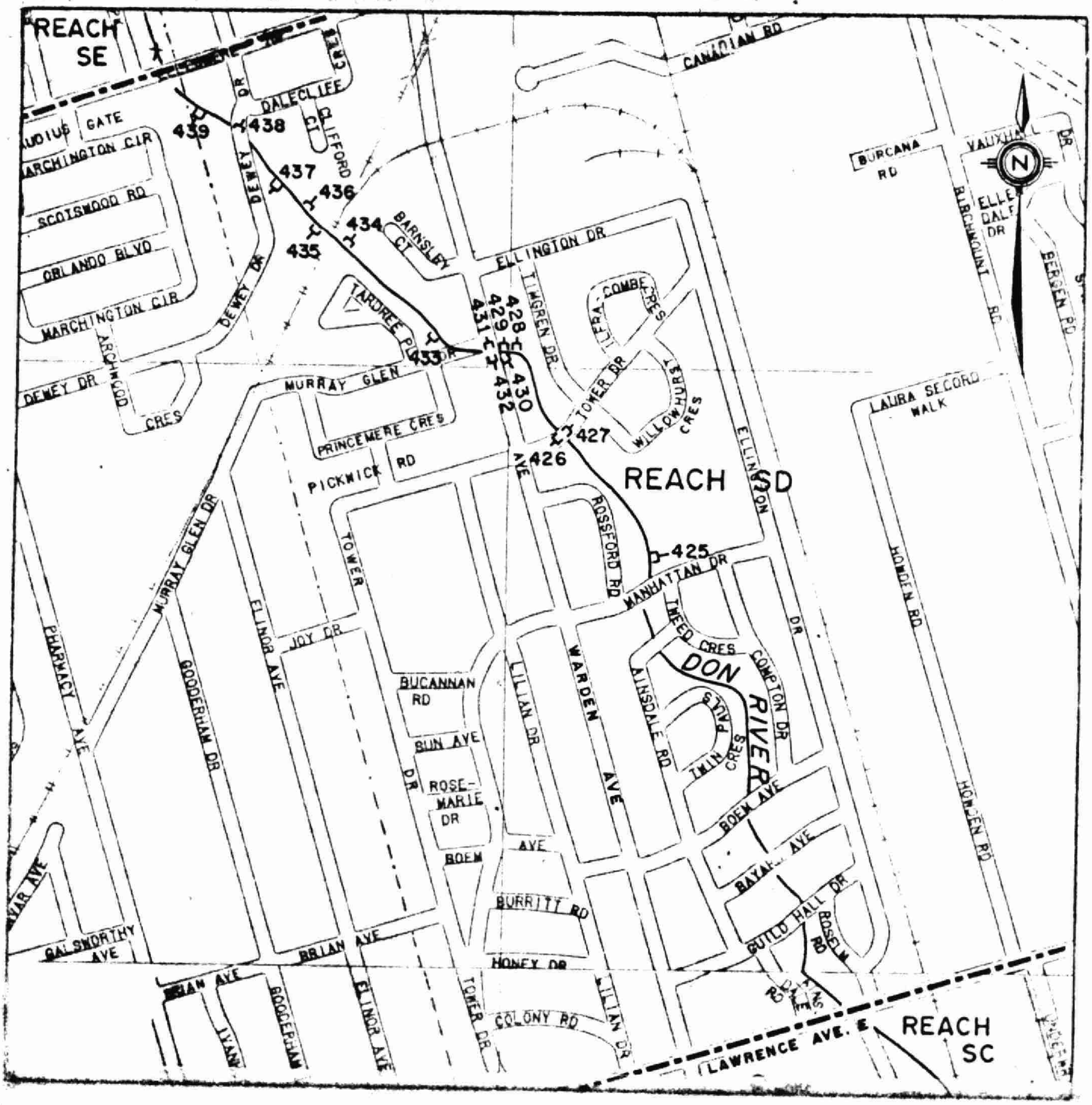
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD.

FIGURE I-64. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH SD



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

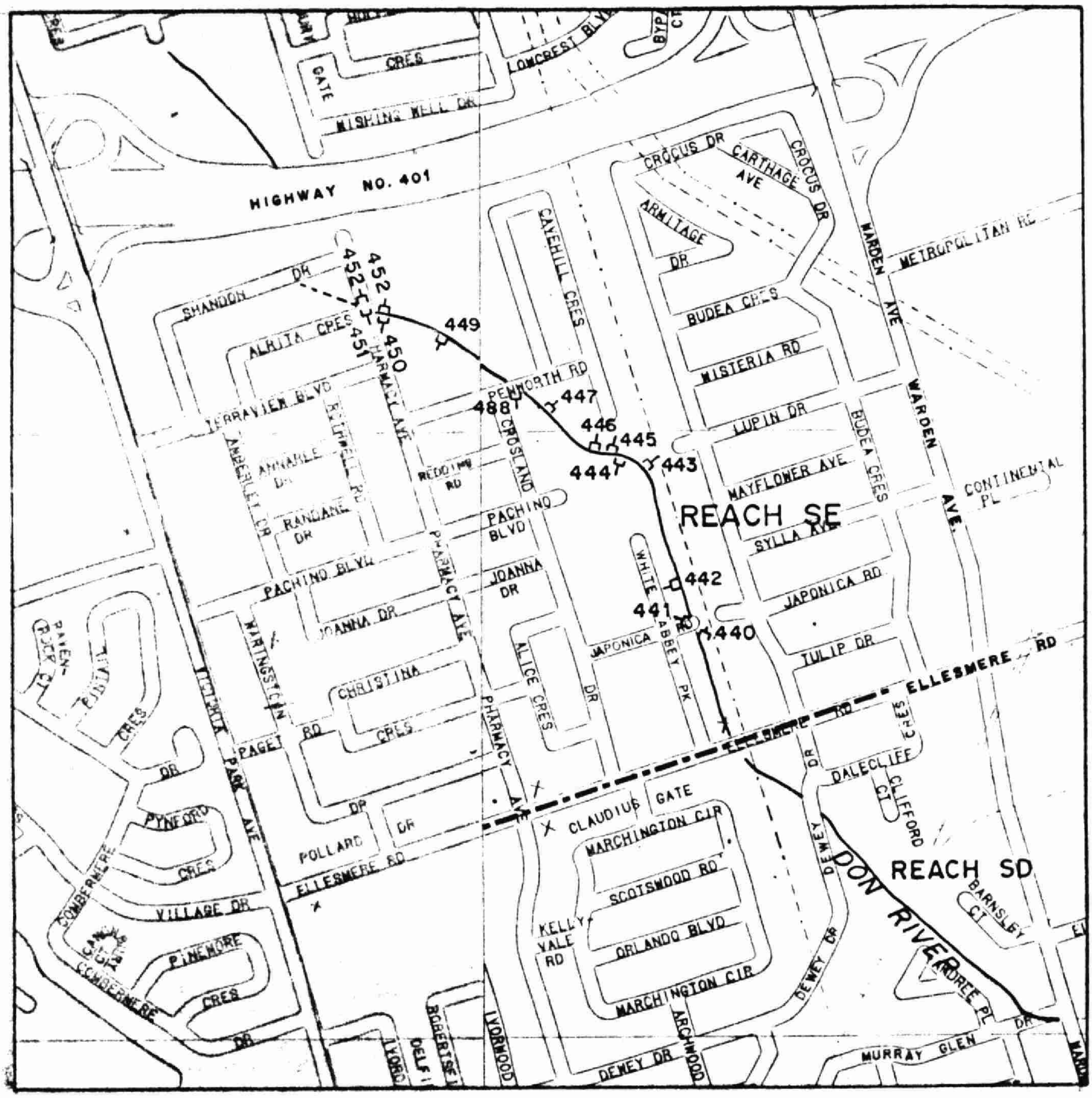
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-65. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH SE



LEGEND

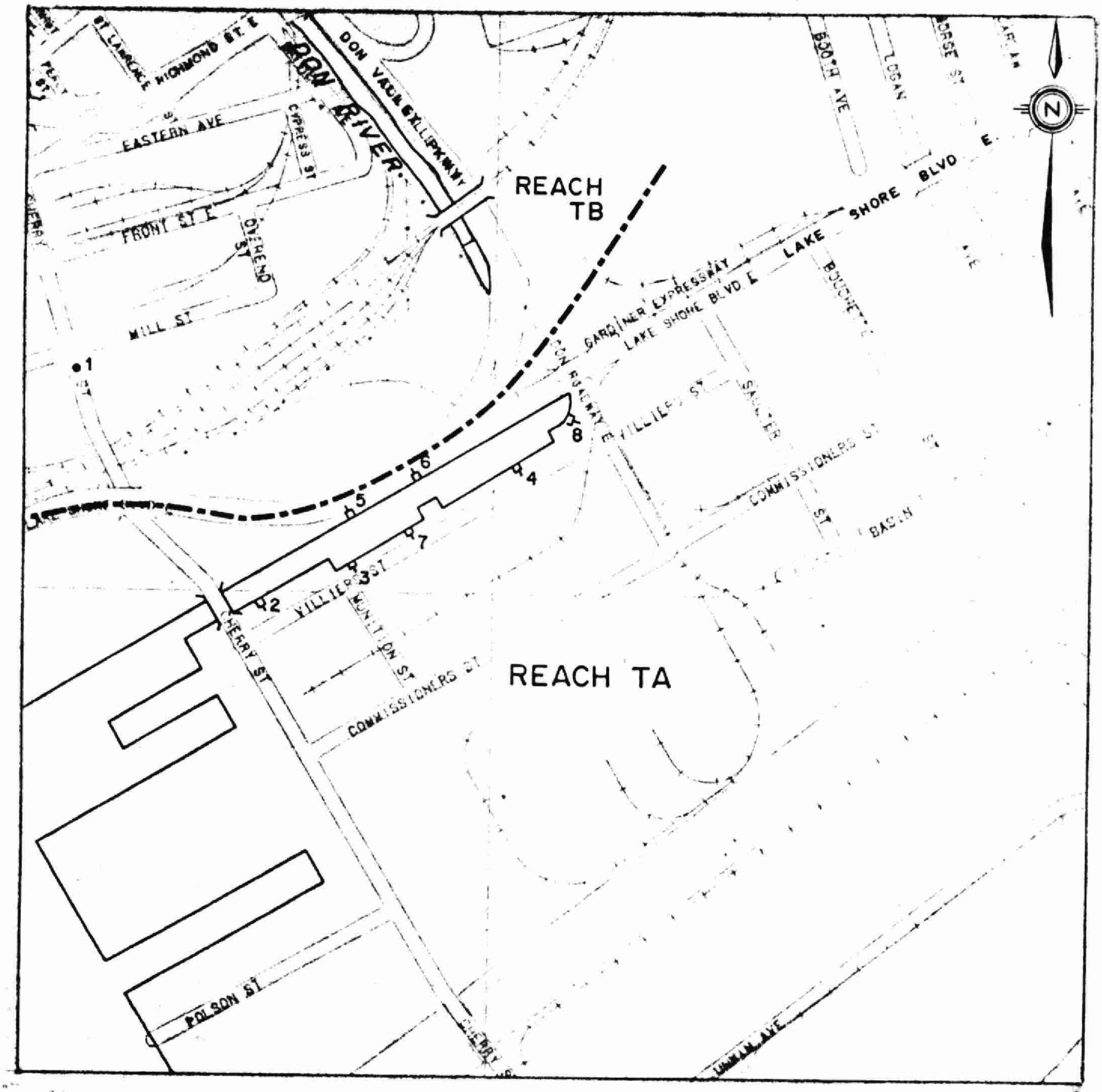
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-66. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH TA



LEGEND

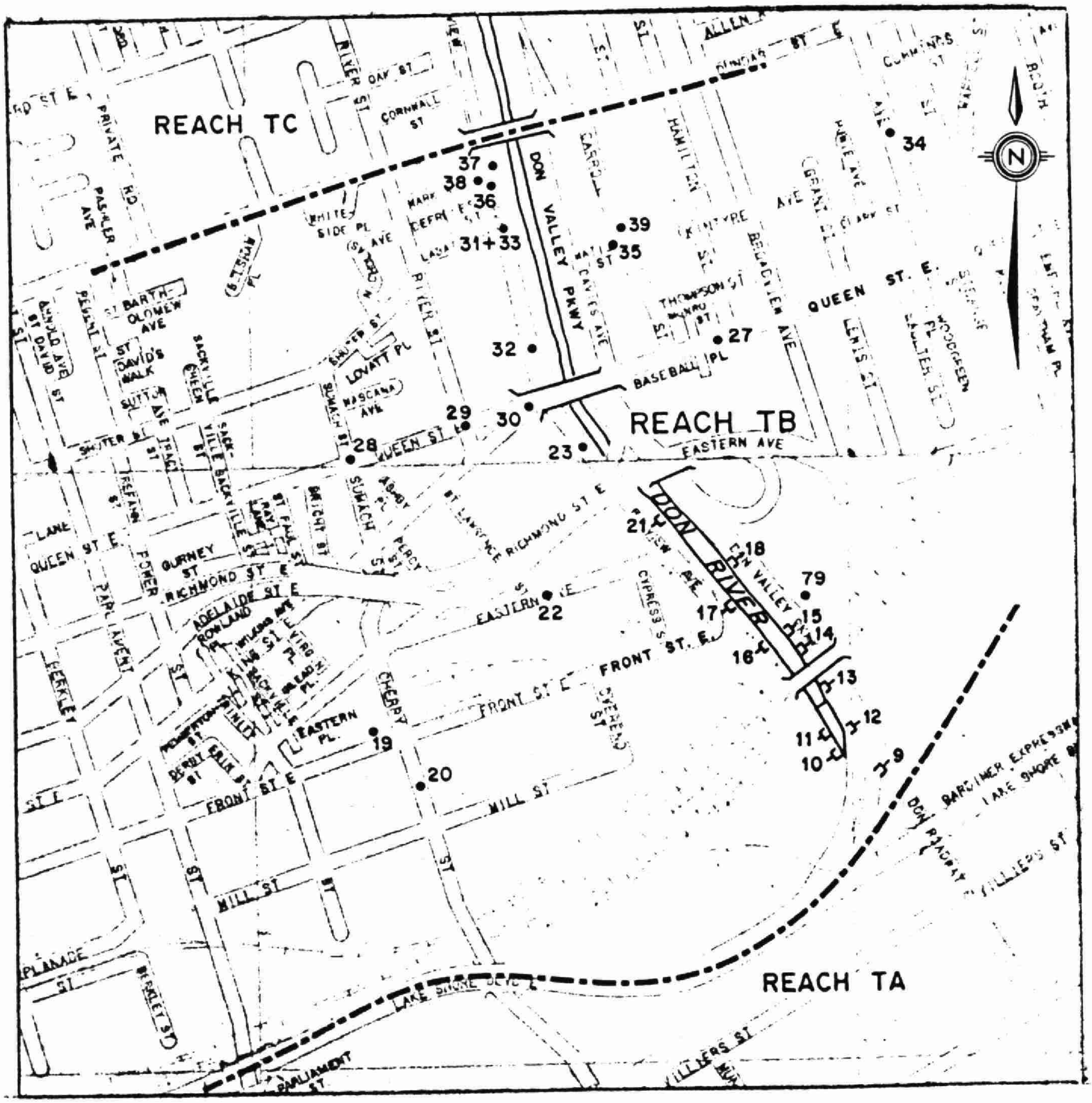
- 804 OUTFALL LOCATION & IDENTIFICATION
- WEIR
- BRIDGE
- REACH BOUNDARY
- UPSTREAM MANHOLE SAMPLE LOCATION

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-67. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH TB



LEGEND

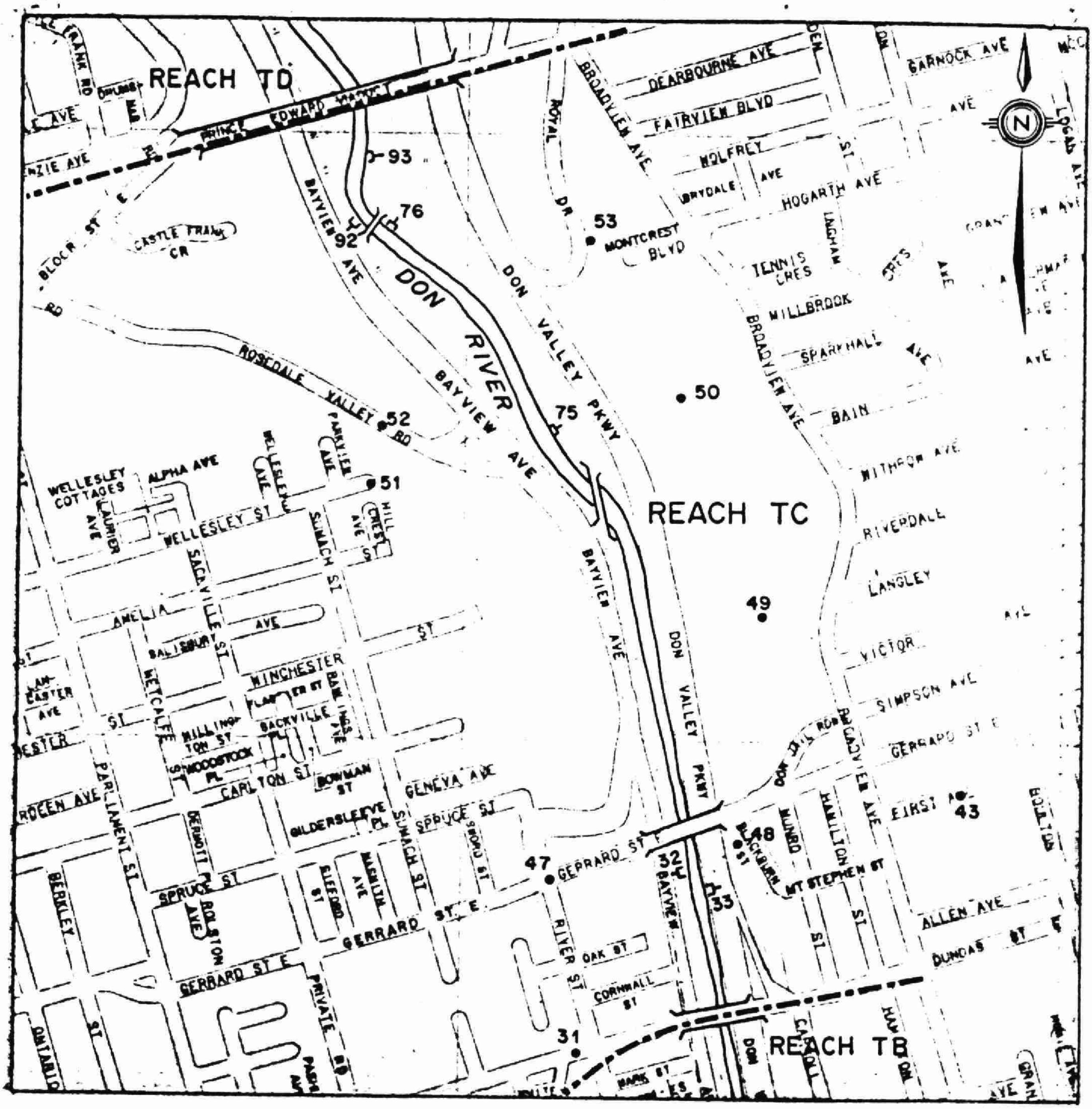
- 804 OUTFALL LOCATION & IDENTIFICATION
- WEIR
- BRIDGE
- REACH BOUNDARY
- • UPSTREAM MANHOLE SAMPLE LOCATION

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD.

FIGURE I-68. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH TC



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

REACH BOUNDARY

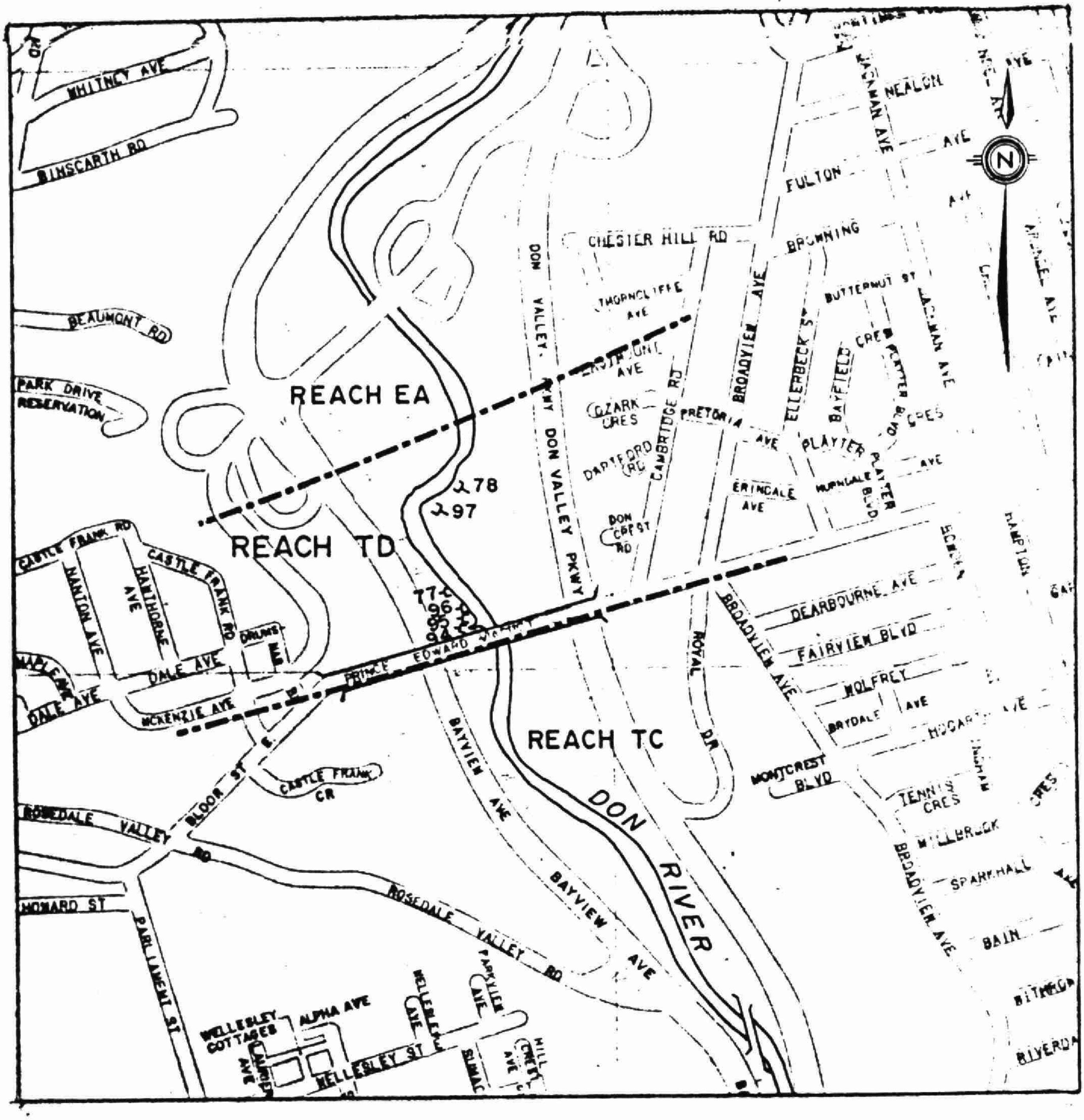
UPSTREAM MANHOLE SAMPLE LOCATION

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-69. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH TD



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

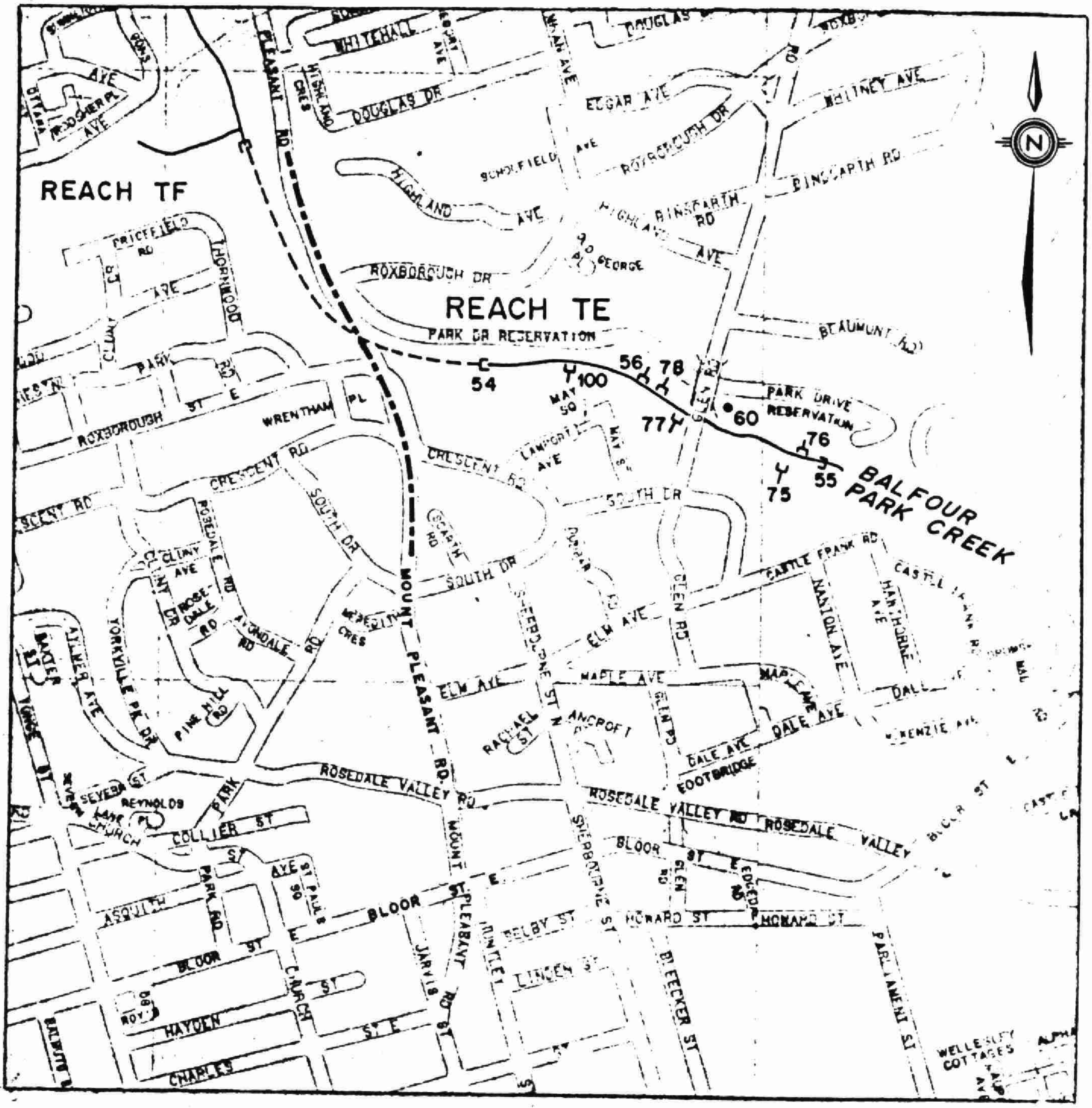
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-70. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH TE



LEGEND

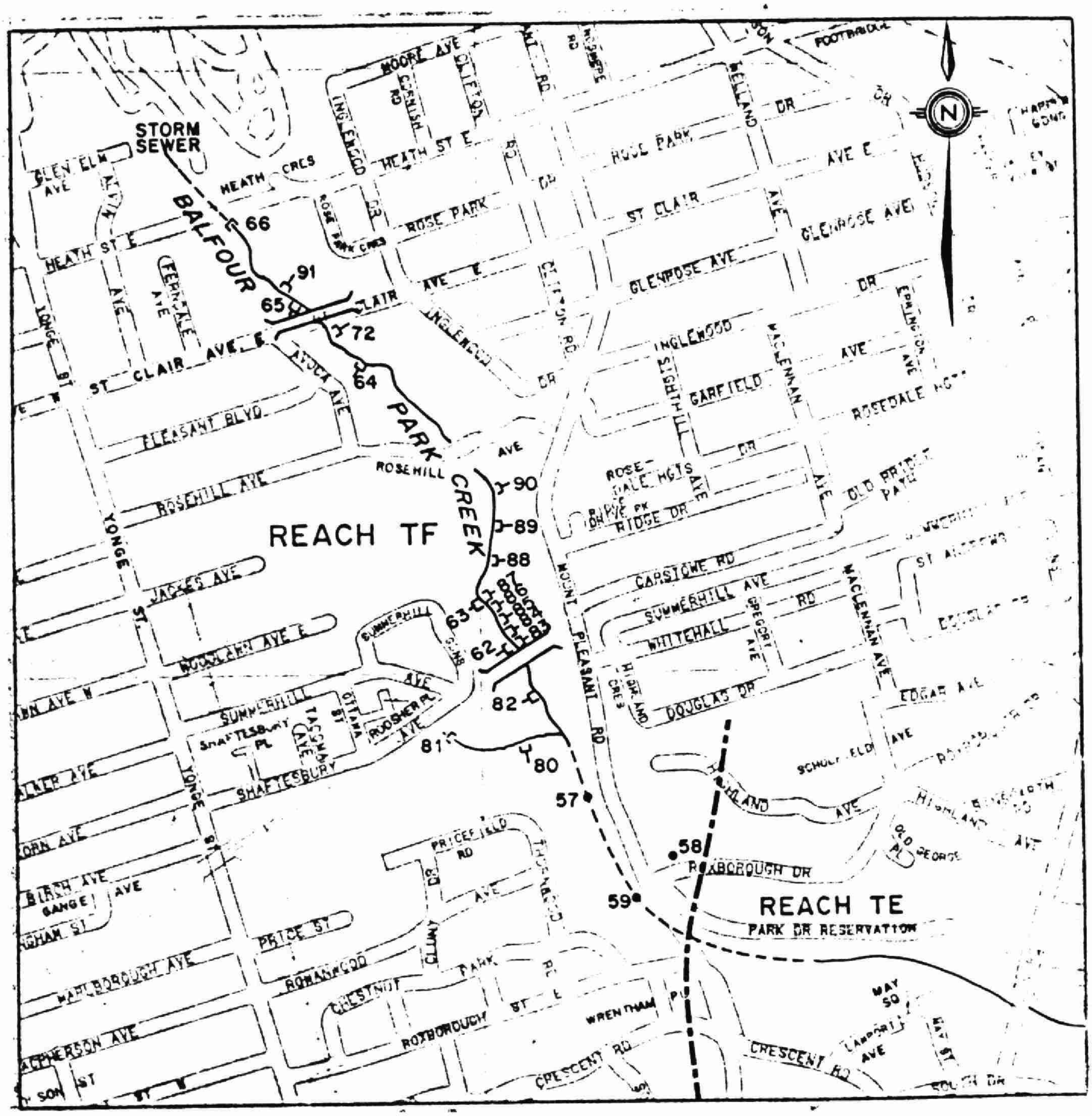
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY
•	UPSTREAM MANHOLE SAMPLE LOCATION

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-71. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH TF



LEGEND

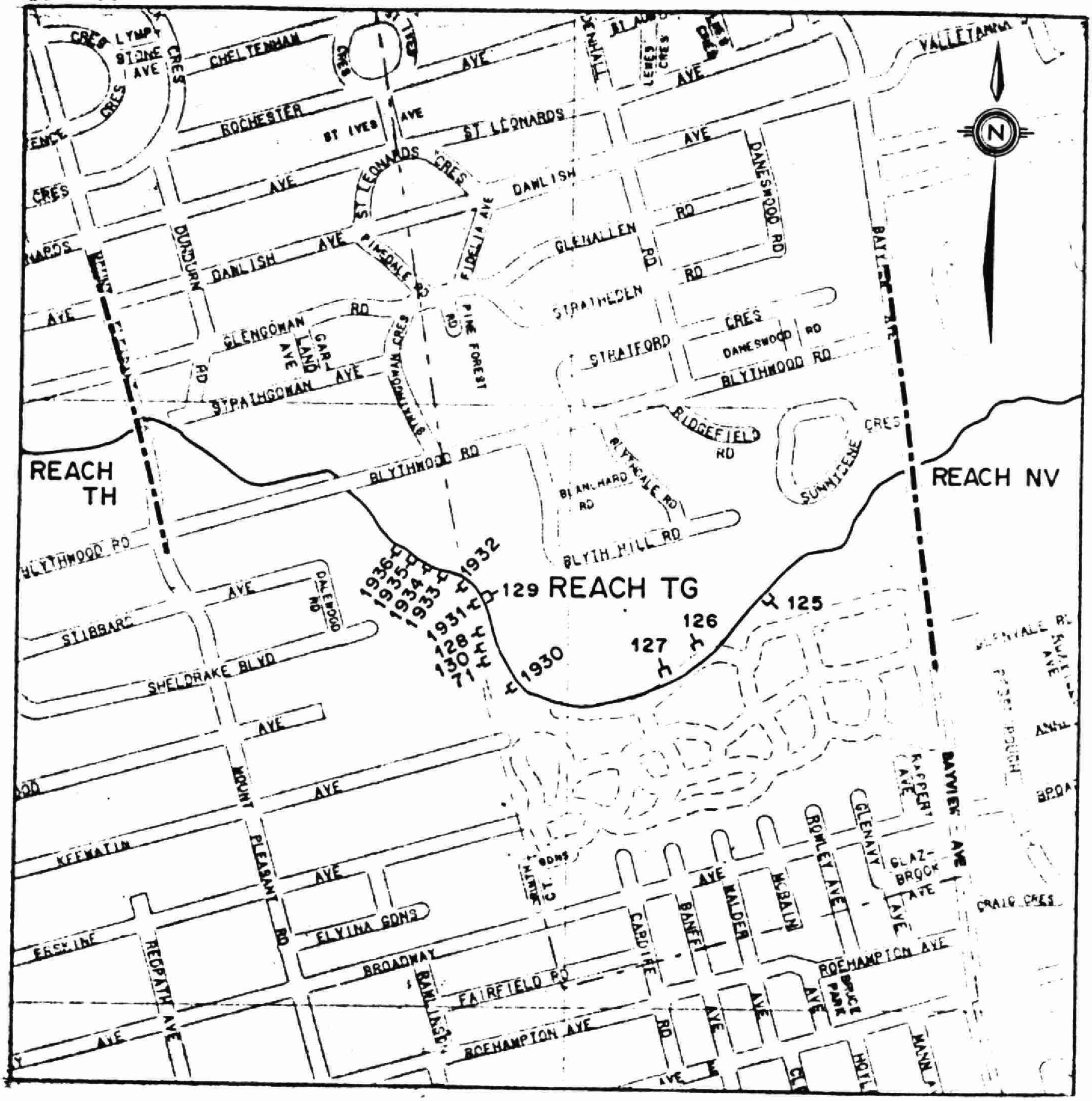
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY
•	UPSTREAM MANHOLE SAMPLE LOCATION

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-72. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH TG



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

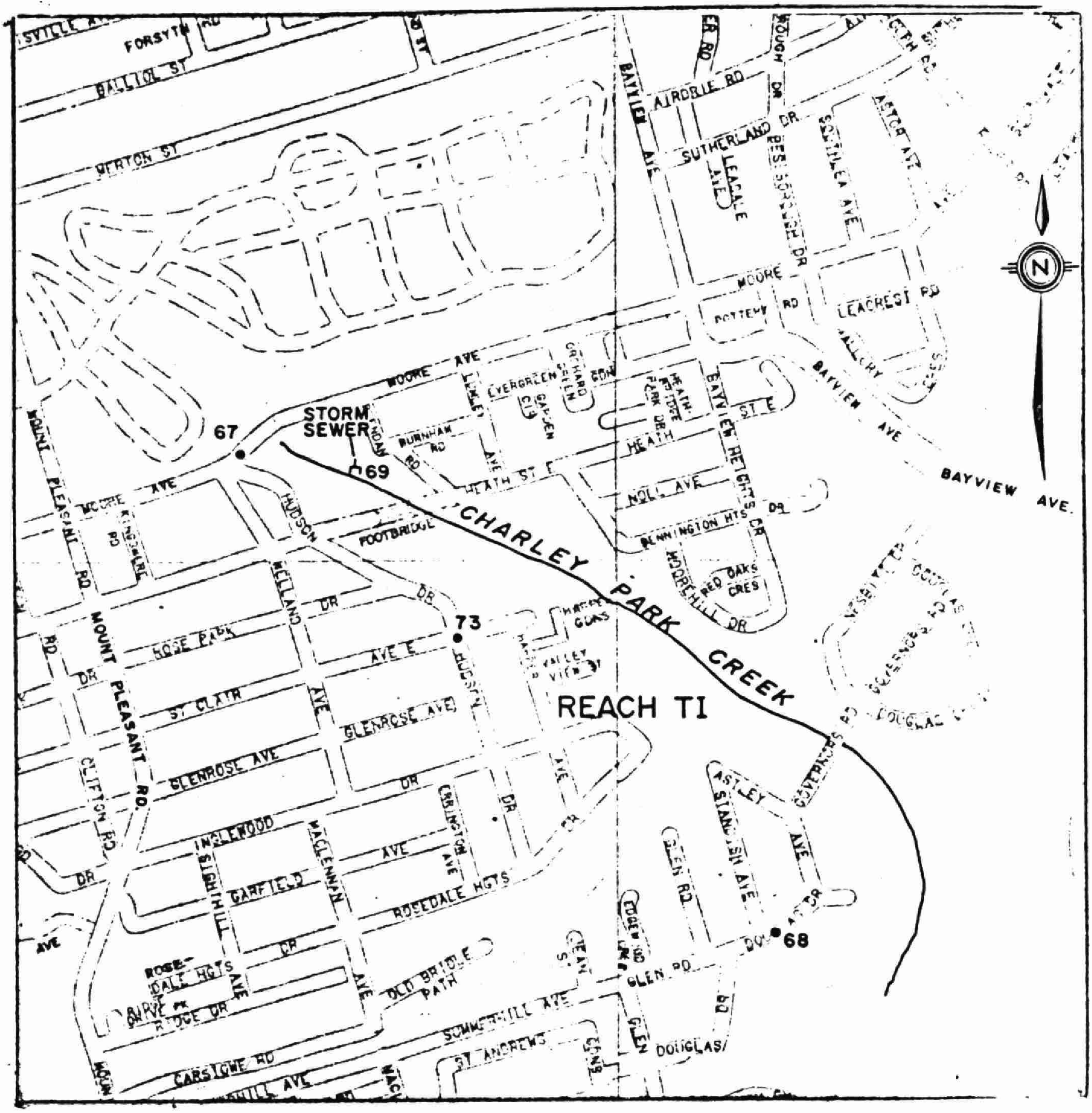
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-73. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH TI



LEGEND

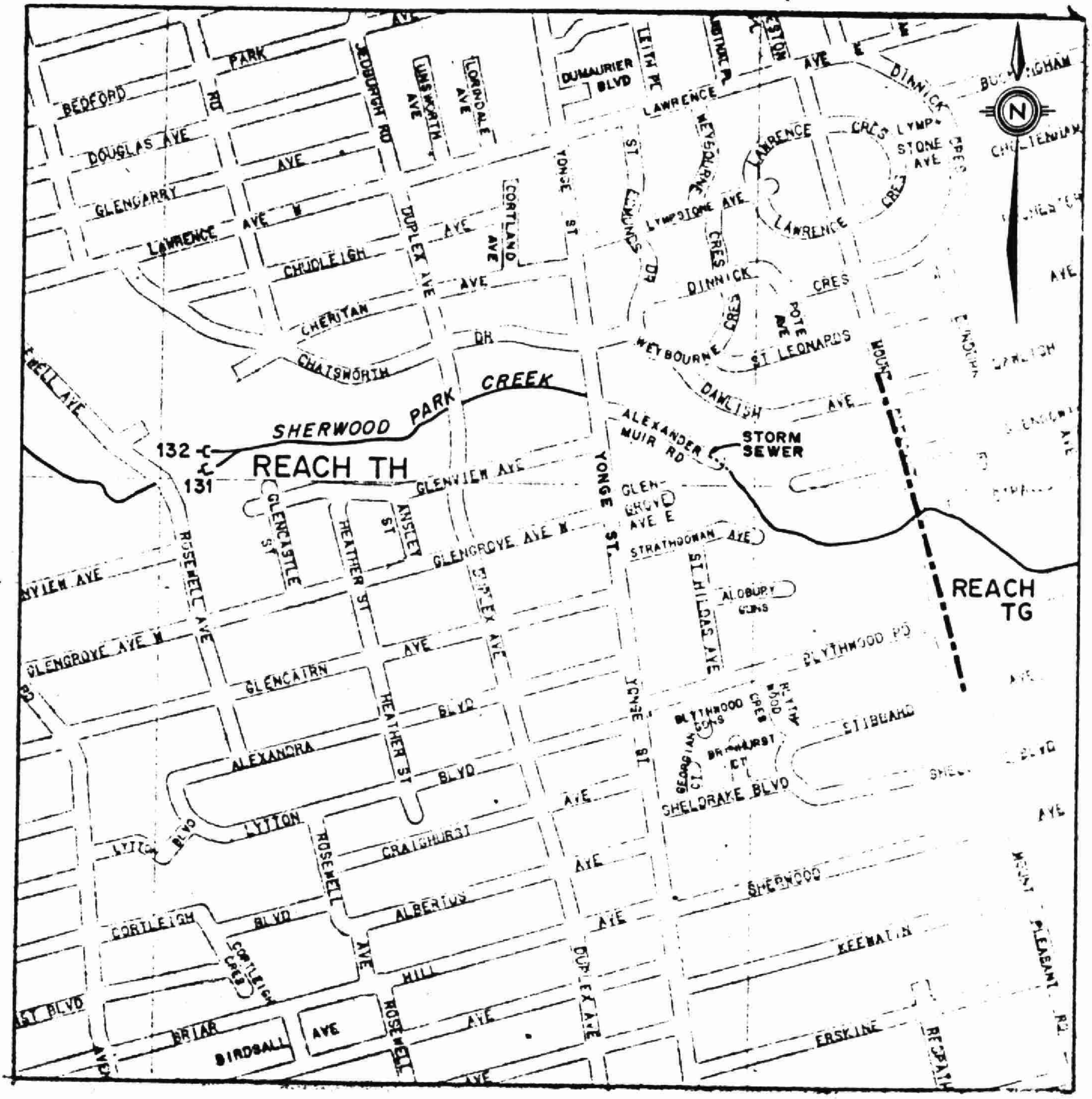
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY
•	UPSTREAM MANHOLE SAMPLE LOCATION

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-74. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH TH



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

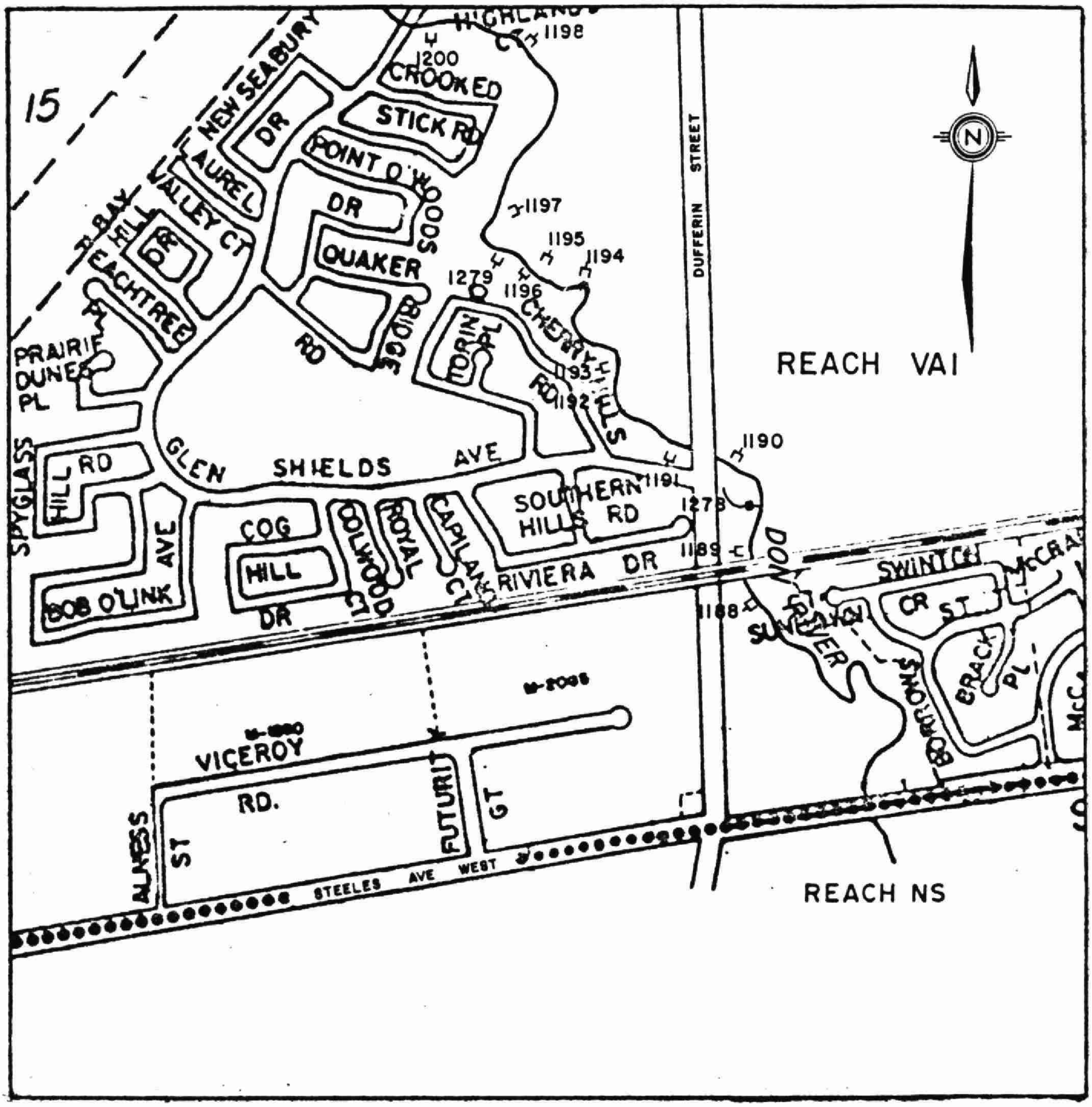
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD.

FIGURE I-75. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH VA1



LEGEND

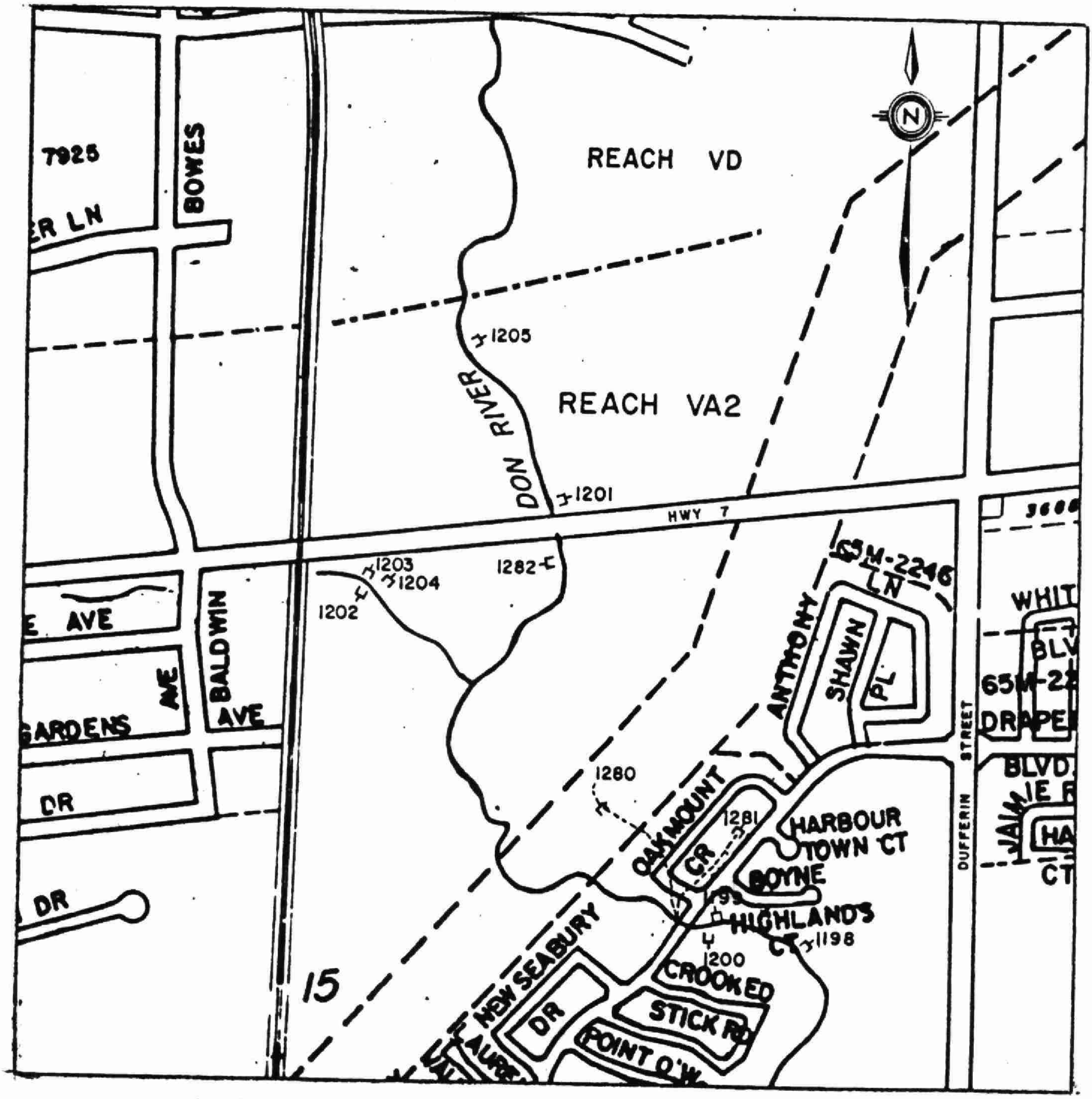
- 804 OUTFALL LOCATION & IDENTIFICATION
- WEIR
- BRIDGE
- REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-76. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH VA2



LEGEND

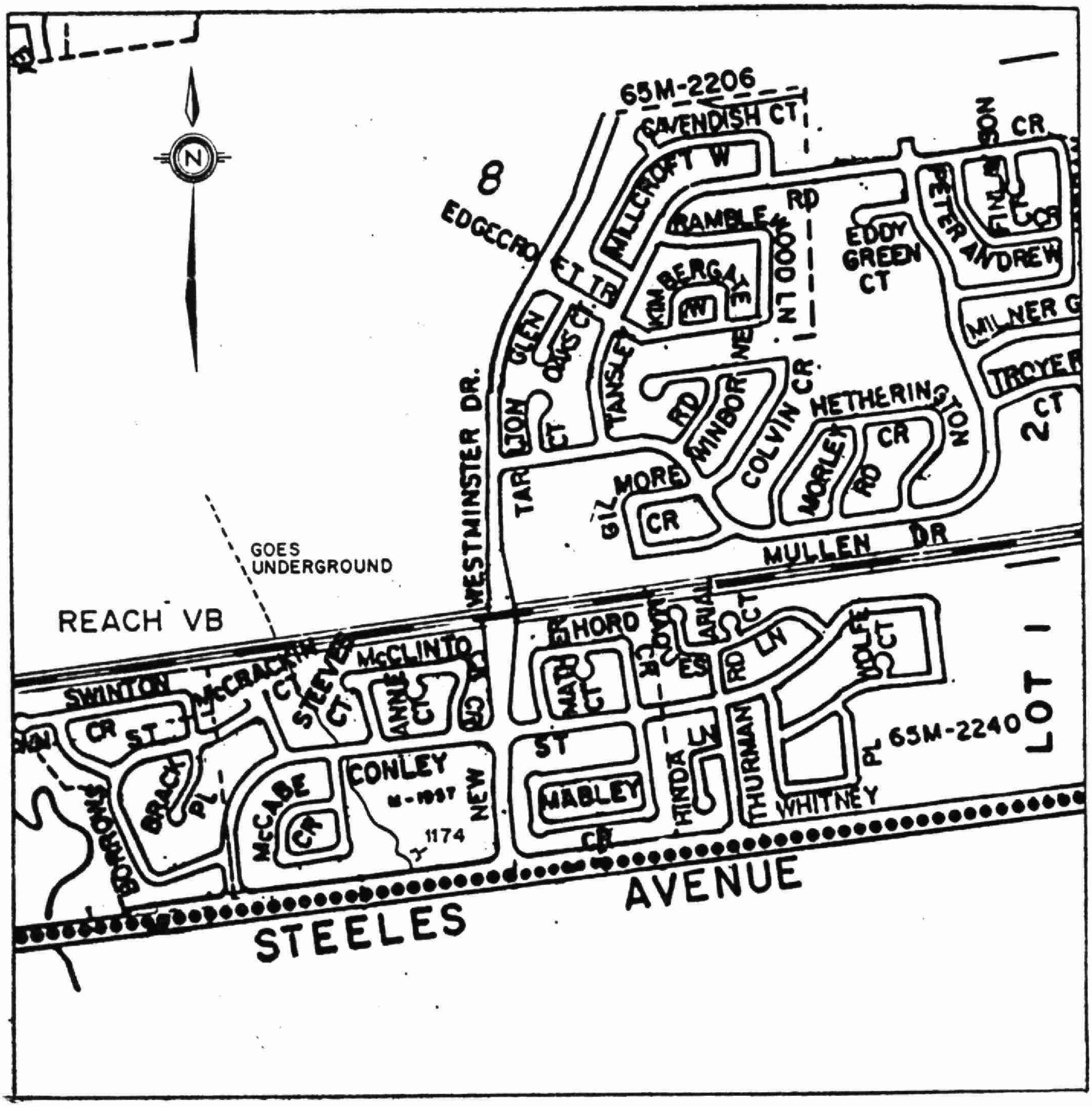
- 804 OUTFALL LOCATION & IDENTIFICATION
- WEIR
- BRIDGE
- REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD.

FIGURE I-77. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH VB



LEGEND

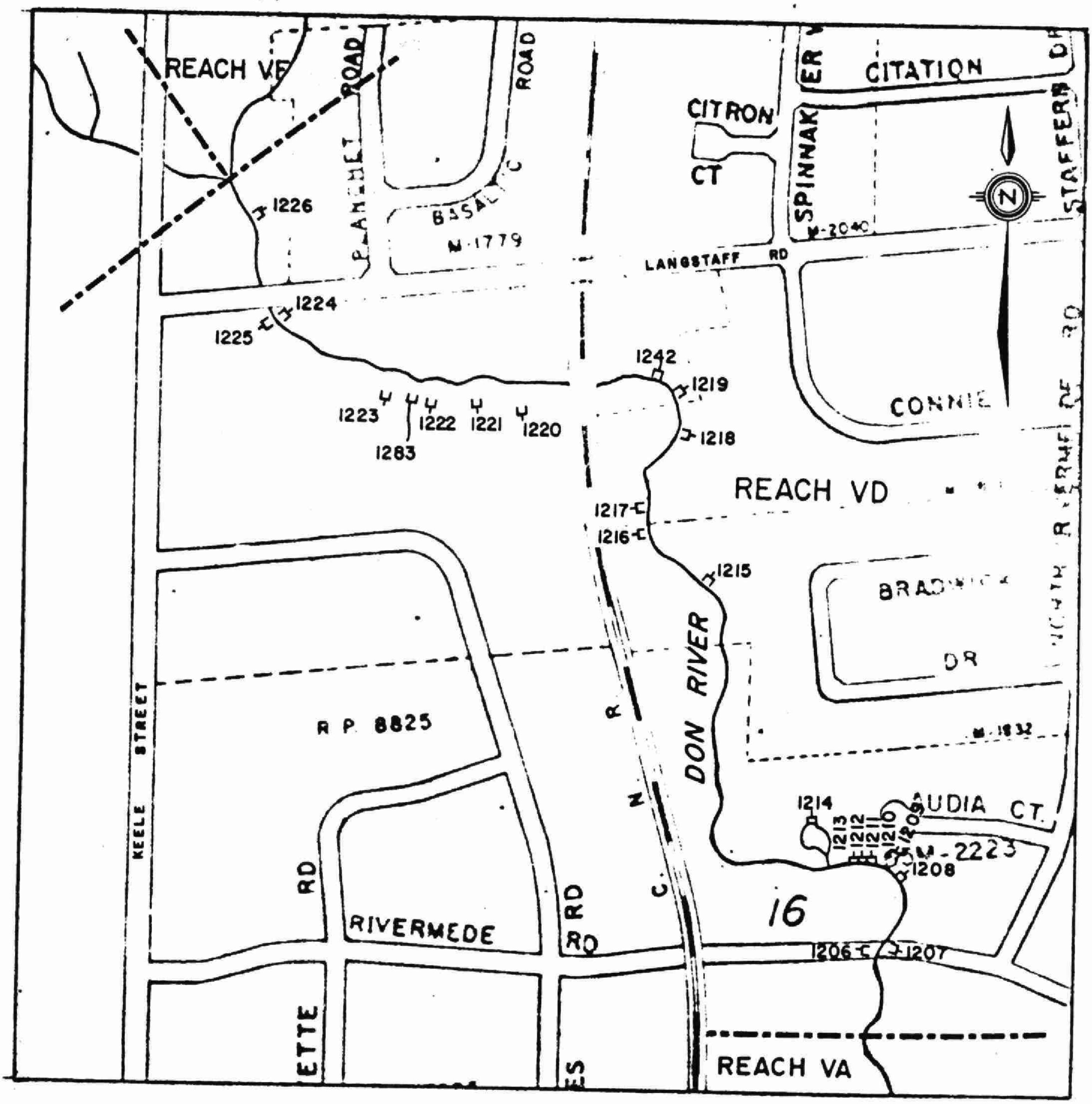
804	OUTFALL LOCATION & IDENTIFICATION
	WEIR
	BRIDGE
	REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD.

FIGURE I-78. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH VD



LEGEND

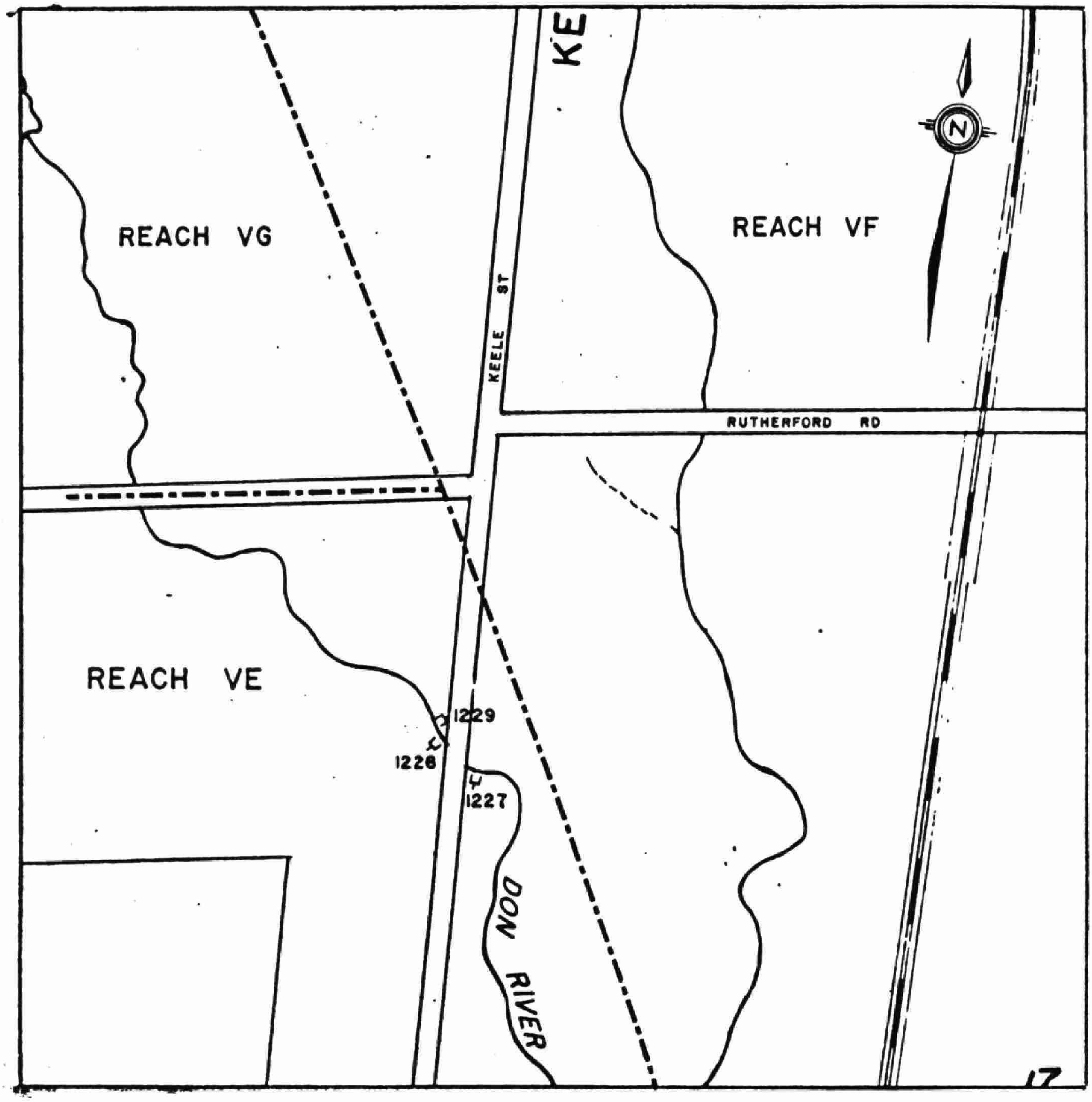
- 804 — OUTFALL LOCATION & IDENTIFICATION
- WEIR
- BRIDGE
- REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-79. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH VE



LEGEND

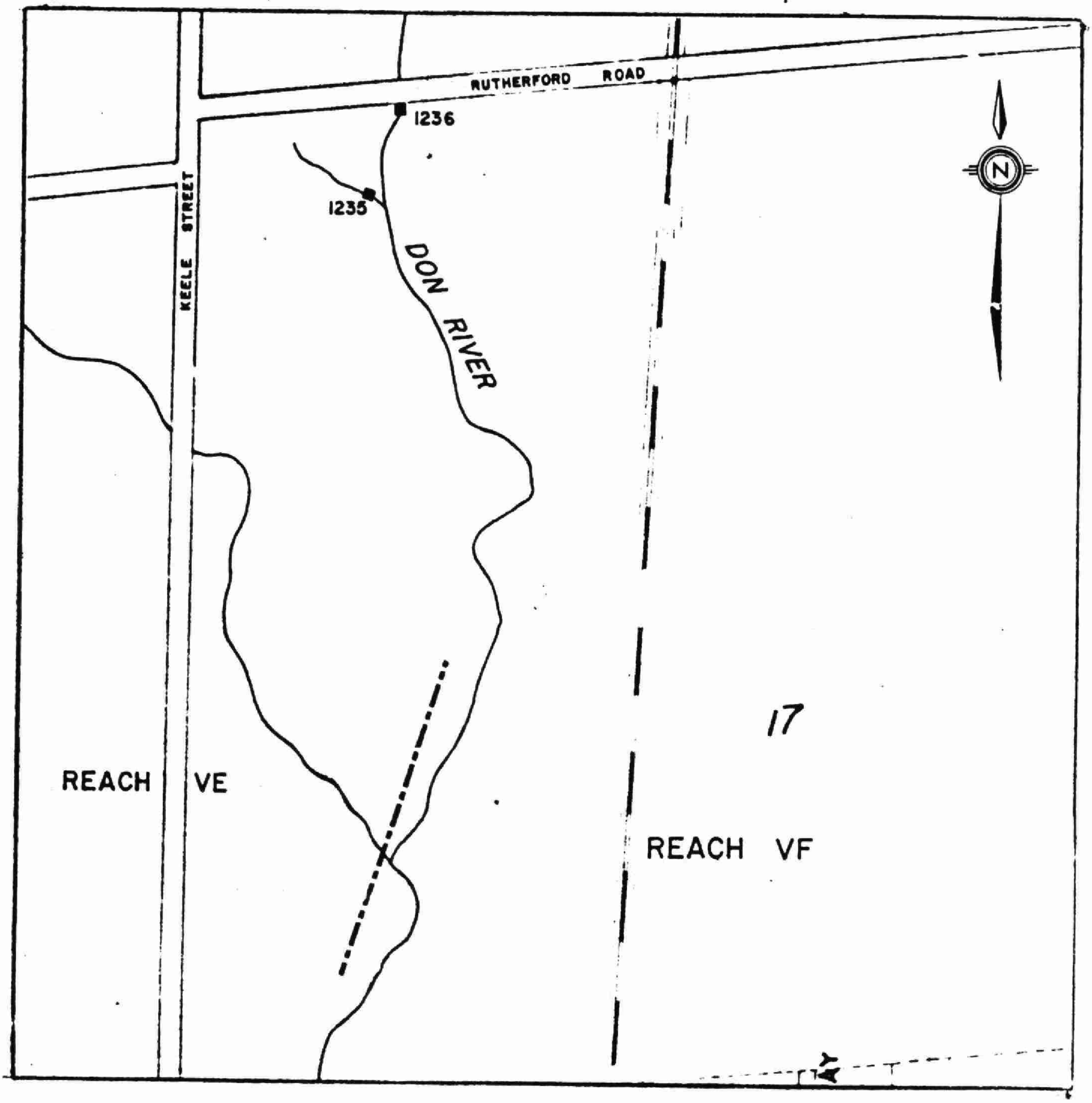
- 804 OUTFALL LOCATION & IDENTIFICATION
- WEIR
- BRIDGE
- REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-80. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH VF



LEGEND

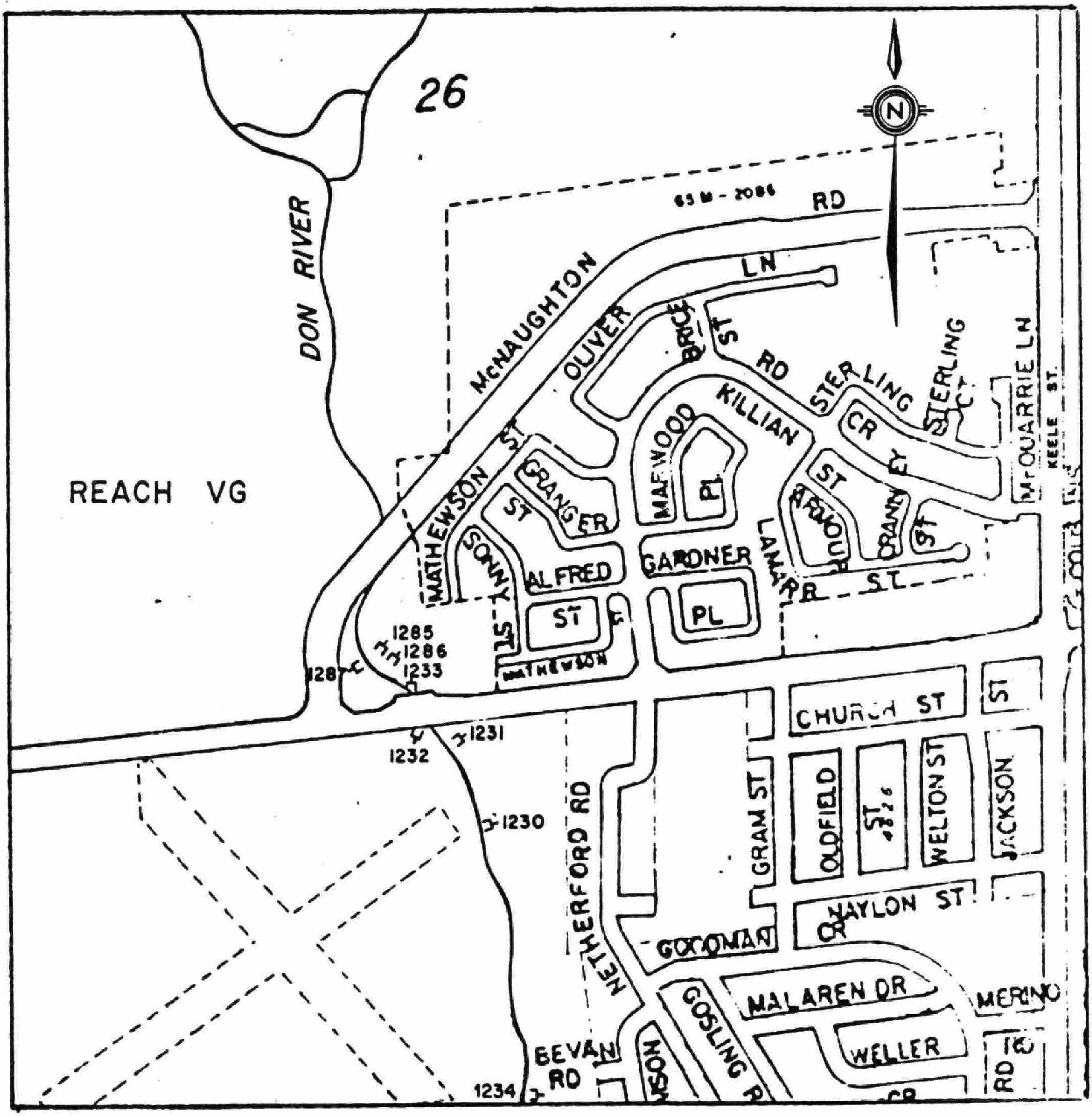
804 OUTFALL LOCATION & IDENTIFICATION
WEIR
BRIDGE
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-81. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH VG



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

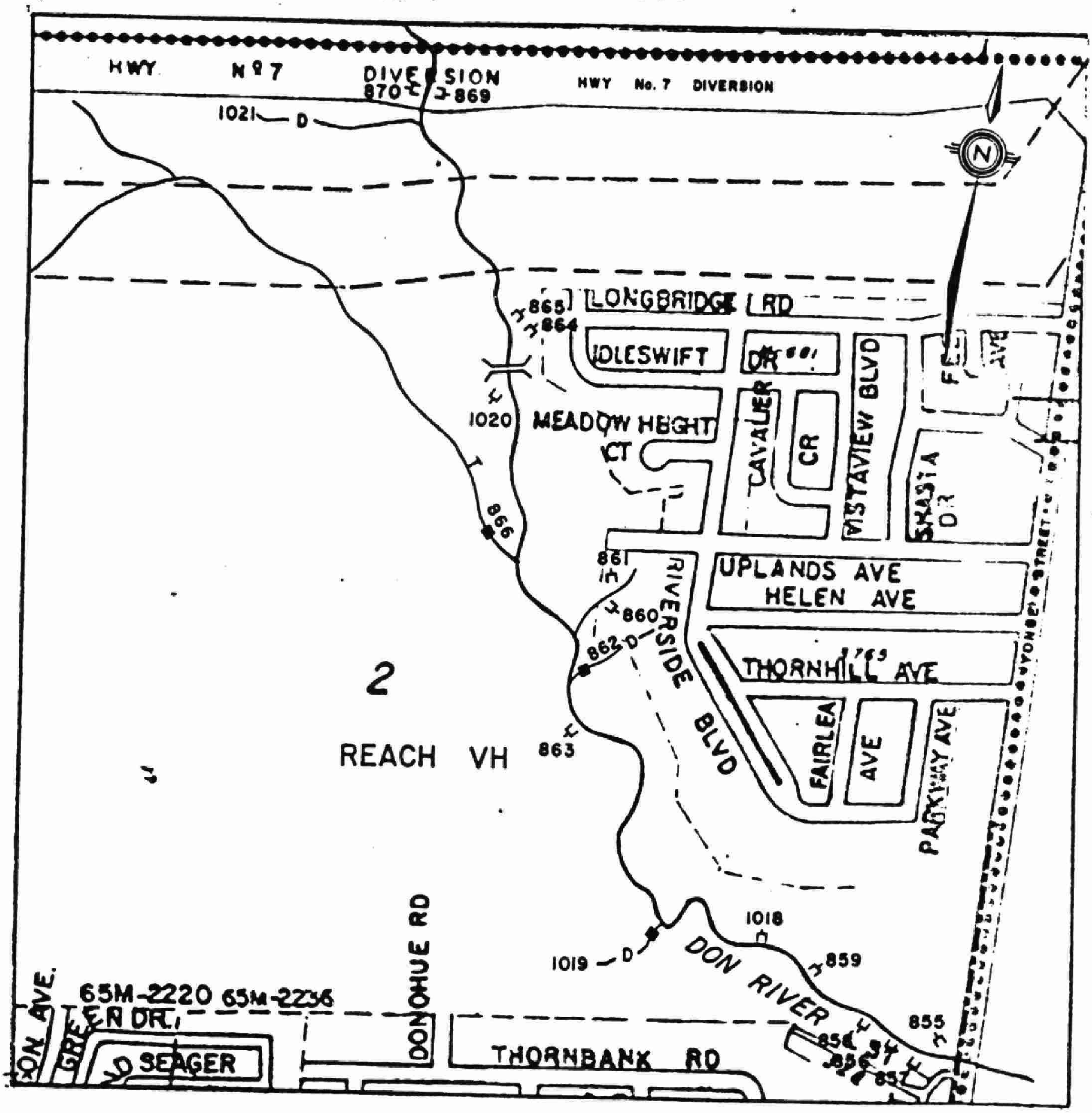
REACH BOUNDARY

SCALE 1:10000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-82. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH VH



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-83. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH VJ

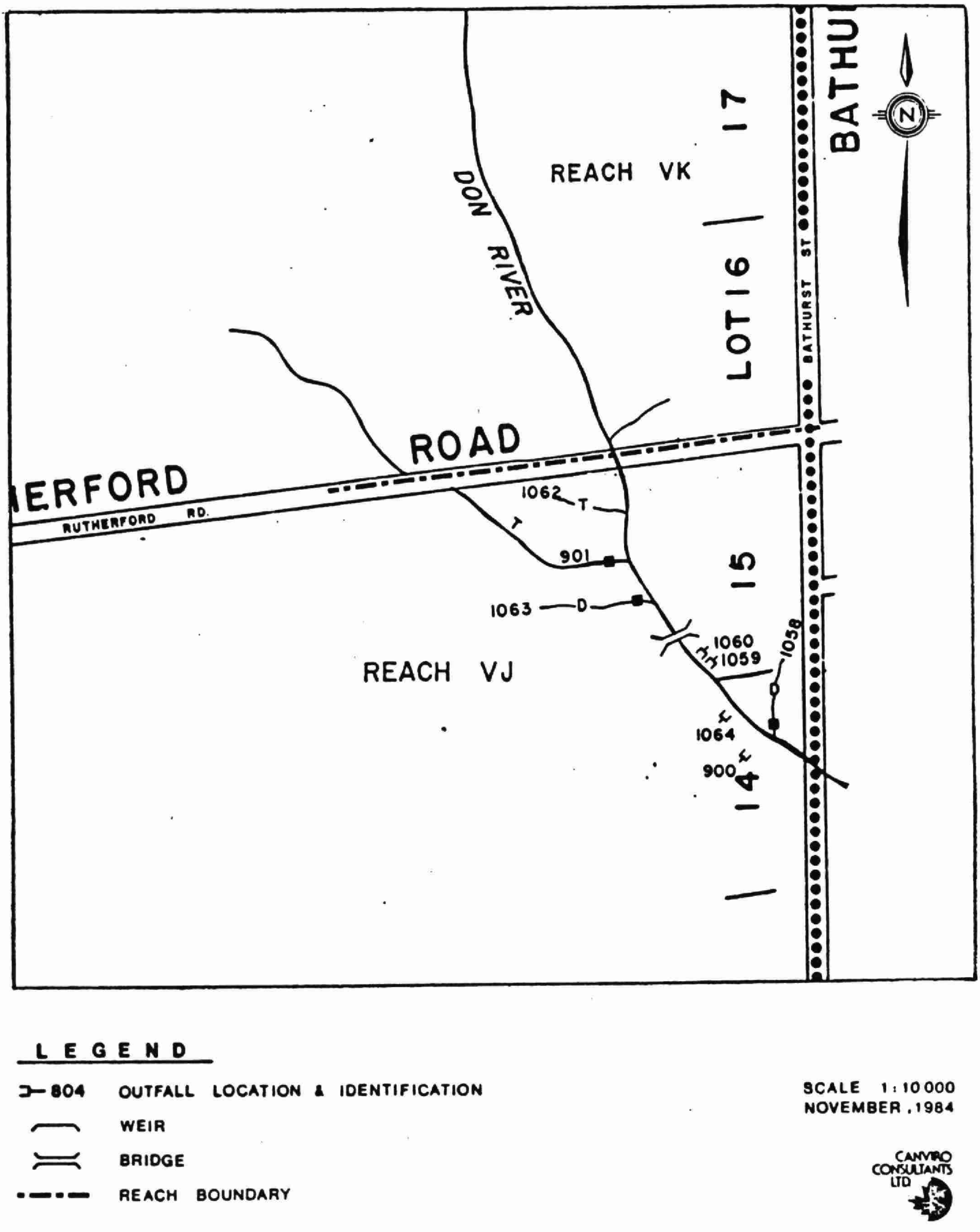
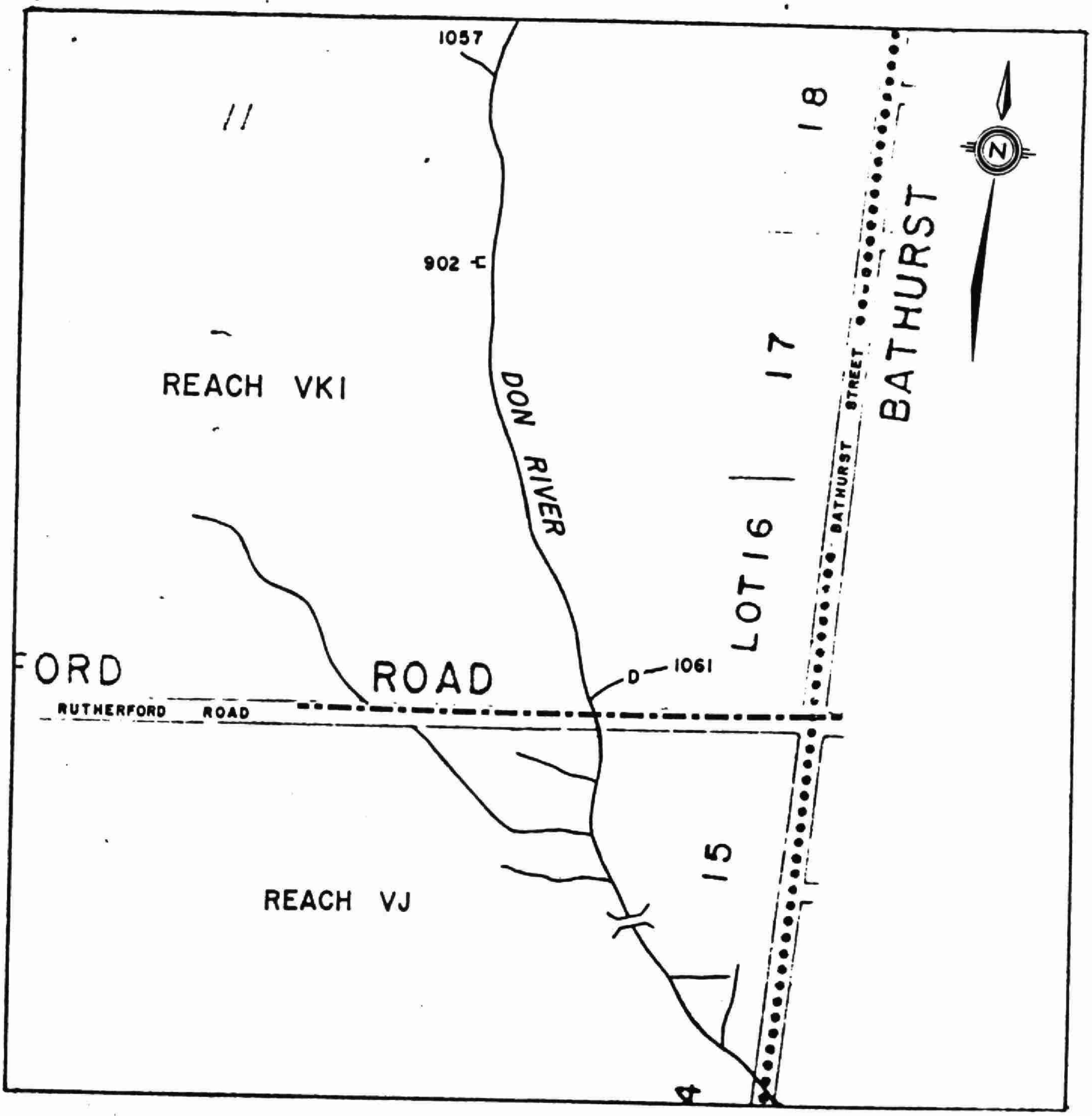


FIGURE I-84. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH VK1



LEGEND

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

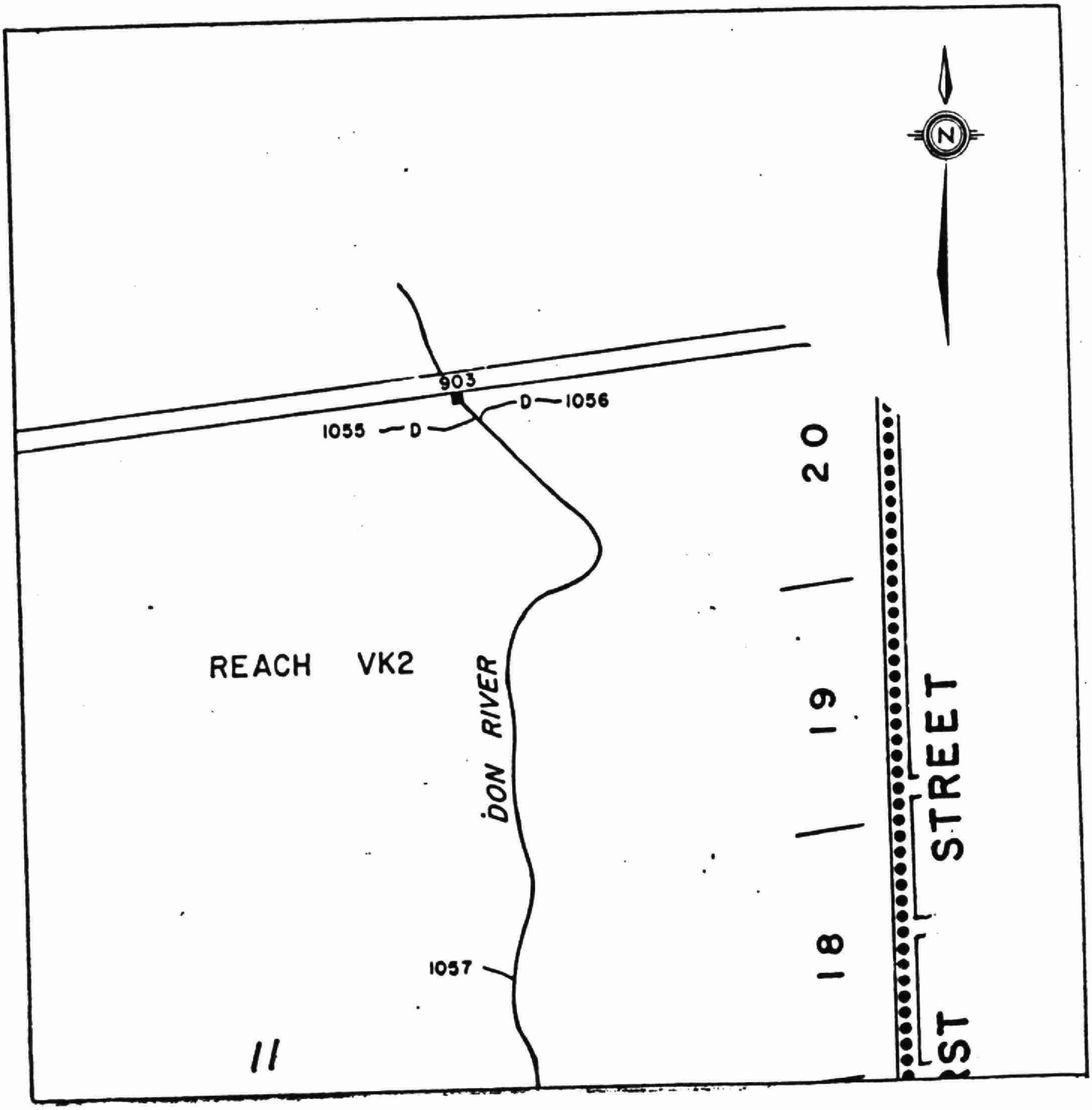
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-85. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH VK2



L E G E N D

804 OUTFALL LOCATION & IDENTIFICATION

WEIR

BRIDGE

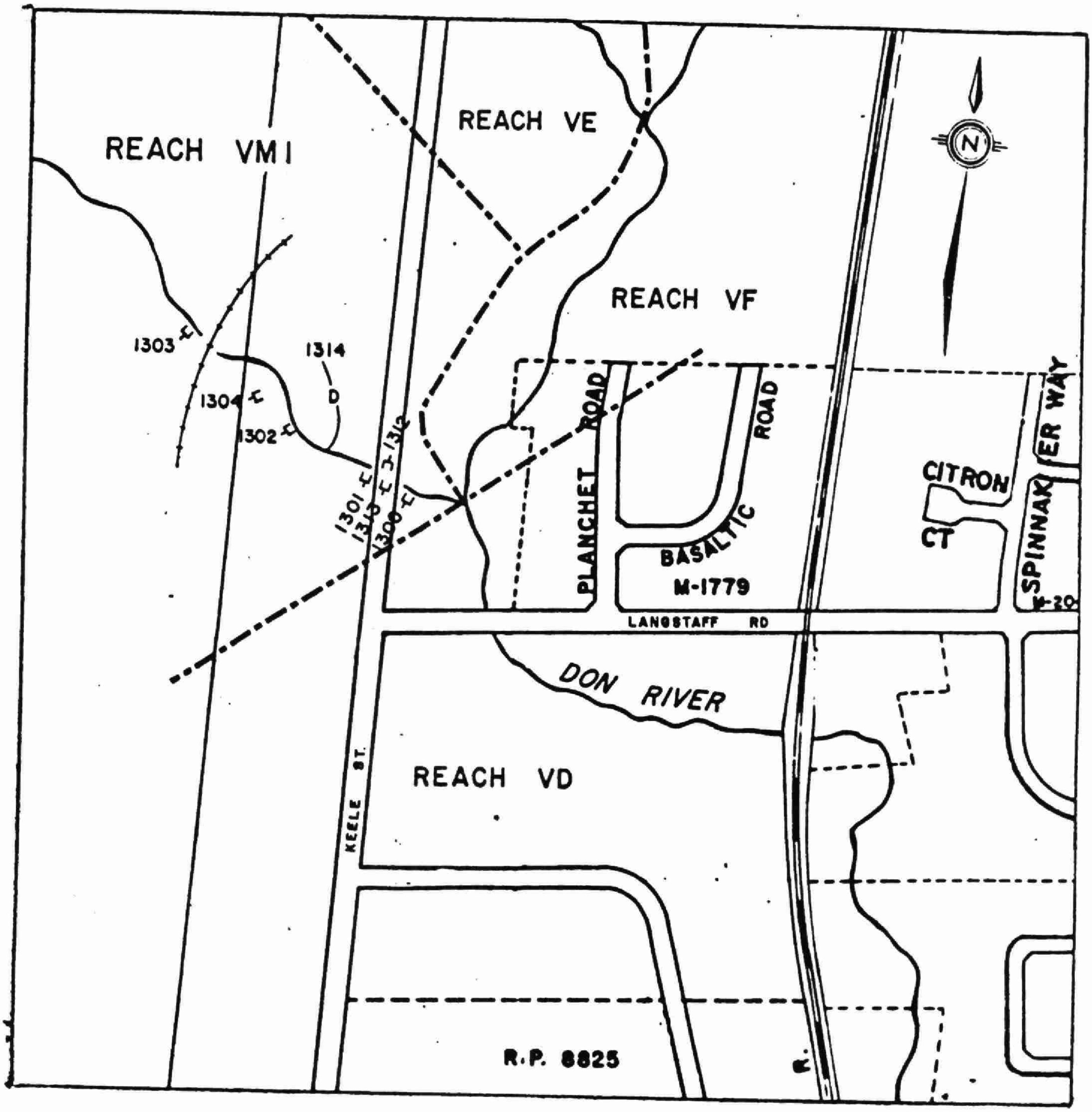
REACH BOUNDARY

SCALE 1:10000
NOVEMBER ,1984

CANVIRO CONSULTANTS LTD

FIGURE I-86. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH VM1



LEGEND

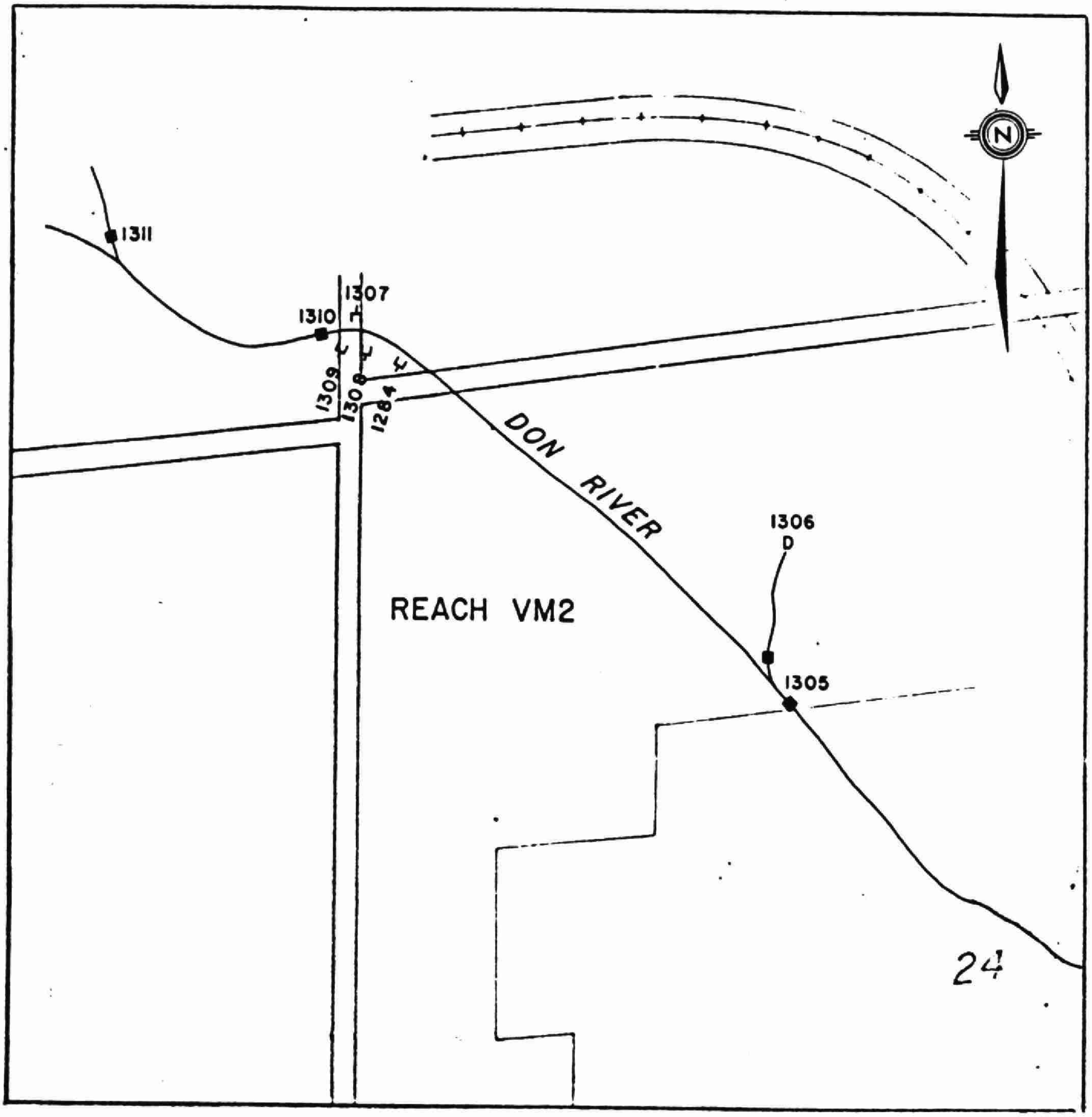
804 OUTFALL LOCATION & IDENTIFICATION
WEIR
BRIDGE
REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-87. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH VM2



LEGEND

- 804 OUTFALL LOCATION & IDENTIFICATION
- WEIR
- BRIDGE
- REACH BOUNDARY

SCALE 1:10 000
NOVEMBER, 1984

CANVIRO CONSULTANTS LTD

FIGURE I-88. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

REACH VP

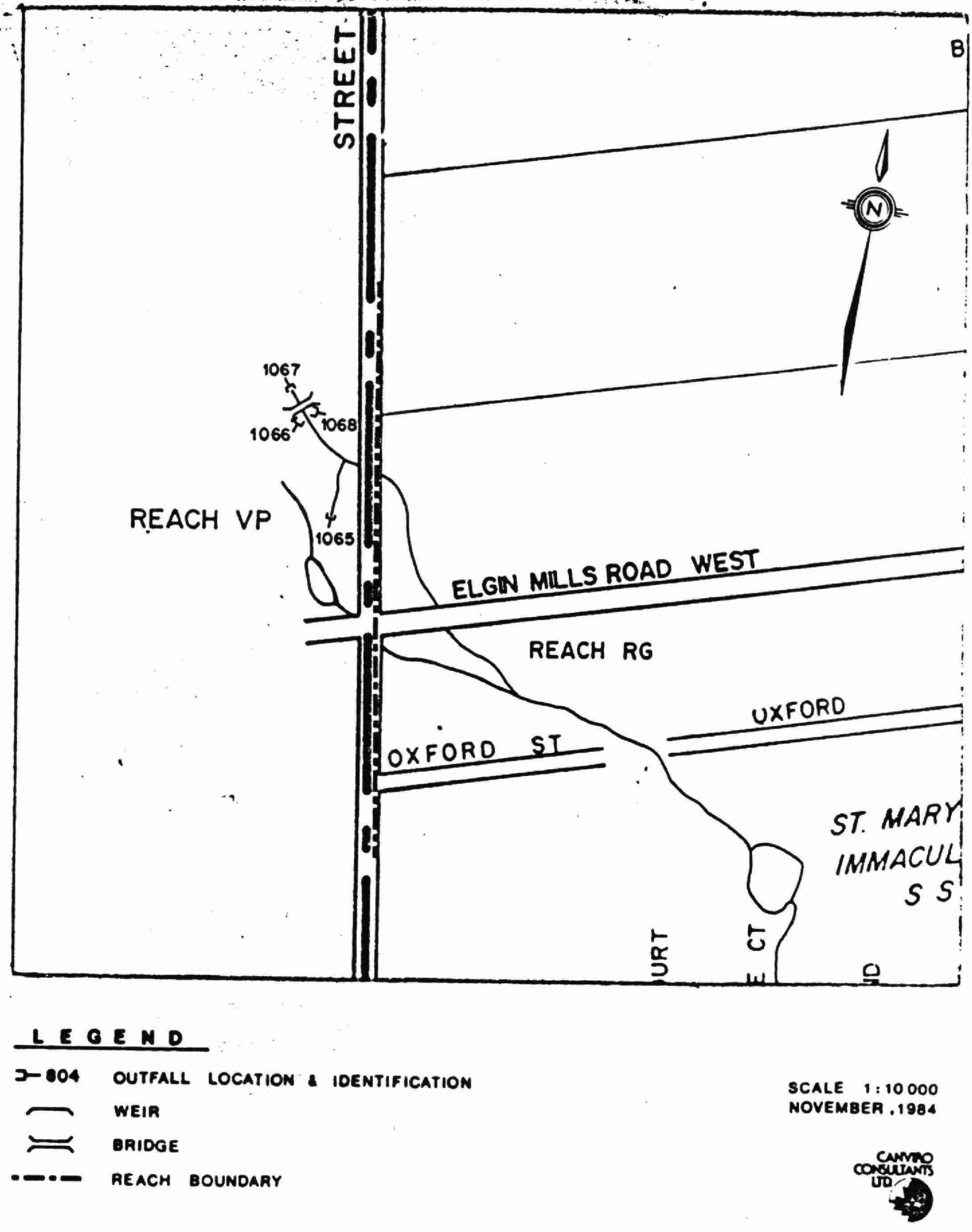


FIGURE I-89. DON RIVER AND TRIBUTARY DRY WEATHER OUTFALL STUDY

APPENDIX II

FIELD SHEET AND FIELD EQUIPMENT

1) Sample Field Data Sheet

2) Definition of Field Data Sheet Entries

3) Equipment List

CANVIRO CONSULTANTS LTD.

FIELD DATA SHEET

DON RIVER OUTFALL SURVEY

CREW: ______________________

DATE: ______________ TIME: ______________

OUTFALL NUMBER: ______________ MUNICIPAL OUTFALL NUMBER: ______________

STREAM NAME: ______________ REACH: ______________

MUNICIPALITY: ______________________

STREET LOCATION: ______________________
(Sketch on Back)

OUTFALL DESCRIPTION:

SIZE: ______________ SHAPE: ______________ MATERIAL: ______________

MAPPING: ______________ PHOTOGRAPH: ______________

SAMPLES:

CONVENTIONAL ______________ X 1.0

BACTERIA ______________ X 0.2

METALS (HNO_3) ______________ X 0.5

OTHER ______________

LAST PRECIPITATION (Hrs):

OUTFALL FLOW MEASUREMENT:

ON-SITE TESTS:

CONDUCTIVITY (umohs): ________ /T: ________ pH: ________

TEMPERATURE: ______________

OBSERVATIONS/COMMENTS:

DESCRIPTION OF FIELD DATA SHEET

Crew: The names or assigned number of the survey crew.

Date: The date that the outfall was visited.

Time: The time that the outfall was visited.

Outfall Number:
The number that was assigned to the outfall upon the first visit.

Municipal Outfall Number:
If applicable, any number which a municipality had previously assigned to the particular outfall.

Stream Name:
The given name for the particular section of the river.

Reach: The assigned letter code distinguishing the section or area of the stream. (Note: First letter represents the municipality; i.e. N for North York, V for Vaughan, E for East York, R for Richmond Hill, S for Scarborough, T for Toronto).

Municipality:
The municipality within which the outfall was located.

Street Location:
The nearest and most relevant streets were listed in this section as well as the compass direction relative to those streets. A sketch was prepared which showed the location of the outfall relative to the river, nearby streets and important structural landmarks.

<u>Outfall Description</u>

Size: The inside dimensions of any man-made outfall measured in inches.

Shape: The outfall configuration was described in this section. The distinctive shapes were given short forms; i.e. circ (circular), rect (rectangular), oval (oval), BH (beehive), HS (horse shoe), semicirc (half a pipe), trib (tributary), ditch (drainage ditch).

Material: The outfall material of construction was described; i.e. CMP (corrugated metal pipe), VC (vitrified clay), STP (steel), PV (plastic), BRI (brick), ACT (asbestos-cement), RCO (reinforced concrete).

Mapping: This refers to whether or not the outfall was listed on the 1:2000 field maps or a municipal map; i.e. whether or not the outfall was known to the surveyors prior to finding it.

Photograph: Indicated that the outfall was photographed.

Samples: If samples were taken, a number representing the number of bottles collected was written after the name of each type of sample. If no sample was taken, suitable reasons were provided.

Last Precipitation:
The hours since the last recorded precipitation was written in this section in hours. This value was determined by the study field supervisor each morning.

Outfall Flow Measurements:
The measured flow in litres per second was recorded in this section.

On-Site Tests:
The temperature, pH and conductivity of the effluent from the outfall was measured and noted in this section.

Observations/Comments:
Field crews recorded any additional pertinent information in this section. Specific observations of interest included any odour, colour or debris, the state of repair of the outfall and any unusual observations.

EQUIPMENT LIST USED IN DRY WEATHER OUTFALL SURVEY

Each Field Crew

2 coolers
4 ice packs
1 plastic bucket
1 plastic litre beaker
1 plastic funnel
1 reverse suction bicycle pump with plastic tubing and one way valve
1 stop watch
2-5 1" corks
1 can fluorescent spray paint
1 35 mm camera with slide film
1 6 m tape measure
1 flexible metal ruler
1 respirator
1 metric thermometer
2 pr work gloves
2 pr rubber gloves
2 pr rubber safety boots
2 pr waders (1 chest, 1 hip)
2 back packs
2 sets sample bottles
1 set field maps, aerial photographs
1 bottle concentrated nitric acid

Laboratory Equipment

1 conductivity bridge
1 pH meter

APPENDIX III

DATA BASE DEFINITIONS

1) Master File Definitions

2) Field Definitions

3) Examples of Typical
   Execution Files

MASTER FILE DESCRIPTION AND FIELD NAMES USED FOR THE OUTFALL SURVEY

```
FILENAME=DON,SUFFIX=FOC

  SEGNAME=LOCATION,SEGTYPE=S3
    FIELDNAME=MUNICIPALITY, ALIAS=CITY,          FORMAT=A2,       $
    FIELDNAME=REACH,        ALIAS=RCH,           FORMAT=A2,       $
    FIELDNAME=OUTFALL NUM,  ALIAS=OUT,           FORMAT=I4S,      $
    FIELDNAME=MO-NUMBER,    ALIAS=MON,           FORMAT=A6,       $

  SEGNAME=DESCRIPT,PARENT=LOCATION,SEGTYPE=S1
    FIELDNAME=OUTFALL-TYPE, ALIAS=OTYPE,         FORMAT=A2,       $
    FIELDNAME=PIPE-DIM-1,   ALIAS=SIZE1,         FORMAT=I4S,      $
    FIELDNAME=PIPE-DIM-2,   ALIAS=SIZE2,         FORMAT=I4S,      $
    FIELDNAME=DESCRIPTION,  ALIAS=OUIDES,        FORMAT=A25,      $
    FIELDNAME=PIPE MAT,     ALIAS=MATERIAL,      FORMAT=A3,       $

  SEGNAME=ONSITE,PARENT=DESCRIPT,SEGTYPE=S1
    FIELDNAME=DATE,         ALIAS=,              FORMAT=I6DMY,    $
    FIELDNAME=TIME,         ALIAS=,              FORMAT=I4S,      $
    FIELDNAME=LAST PRECIP,  ALIAS=RAIN,          FORMAT=I3S,      $
    FIELDNAME=CREW,         ALIAS=,              FORMAT=A2,       $
    FIELDNAME=CONDUCTIVITY, ALIAS=CON,           FORMAT=I5S,      $
    FIELDNAME=PH,           ALIAS=,              FORMAT=D4.1S,    $
    FIELDNAME=TEMPERATURE,  ALIAS=TEMP,          FORMAT=D4.1S,    $
    FIELDNAME=RF,           ALIAS=,              FORMAT=A1,       $
    FIELDNAME=FLOW,         ALIAS=,              FORMAT=D8.3CS,   $
    FIELDNAME=WET-DRY,      ALIAS=WET,           FORMAT=A1,       $

  SEGNAME=OFFSITE,PARENT=ONSITE,SEGTYPE=S1
    FIELDNAME=REPLICANT,    ALIAS=REP,           FORMAT=I3S,      $
    FIELDNAME=RTP,          ALIAS=,              FORMAT=A1,       $
    FIELDNAME=TOT P,        ALIAS=PHOSPHORUS,    FORMAT=D7.2CS,   $
    FIELDNAME=RTKN,         ALIAS=,              FORMAT=A1,       $
    FIELDNAME=TKN,          ALIAS=,              FORMAT=D6.2CS,   $
    FIELDNAME=RBOD,         ALIAS=,              FORMAT=A1,       $
    FIELDNAME=BOD,          ALIAS=,              FORMAT=D6.1CS,   $
    FIELDNAME=RSS,          ALIAS=,              FORMAT=A1,       $
    FIELDNAME=SUSP-SOLIDS,  ALIAS=SS,            FORMAT=D7.0CS,   $
    FIELDNAME=RPNL,         ALIAS=,              FORMAT=A1,       $
    FIELDNAME=PHENOLS,      ALIAS=,              FORMAT=D7.2CS,   $
    FIELDNAME=RLD,          ALIAS=,              FORMAT=A1,       $
    FIELDNAME=LEAD,         ALIAS=PB,            FORMAT=D6.2CS,   $
    FIELDNAME=RZN,          ALIAS=,              FORMAT=A1,       $
    FIELDNAME=ZINC,         ALIAS=ZN,            FORMAT=D6.3CS,   $
    FIELDNAME=RCU,          ALIAS=,              FORMAT=A1,       $
    FIELDNAME=COPPER,       ALIAS=CU,            FORMAT=D7.3CS,   $
    FIELDNAME=RCHR,         ALIAS=,              FORMAT=A1,       $
    FIELDNAME=CHROME,       ALIAS=,              FORMAT=D6.3CS,   $
    FIELDNAME=RIR,          ALIAS=,              FORMAT=A1,       $
    FIELDNAME=IRON,         ALIAS=FE,            FORMAT=D6.2CS,   $
    FIELDNAME=RFC,          ALIAS=,              FORMAT=A1,       $
    FIELDNAME=FECAL COLI,   ALIAS=FC,            FORMAT=I9CS,     $
    FIELDNAME=RFS,          ALIAS=,              FORMAT=A1,       $
    FIELDNAME=FECAL STREP,  ALIAS=FS,            FORMAT=I9CS,     $
    FIELDNAME=RUN-NO,       ALIAS=RUN,           FORMAT=A2,       $
    FIELDNAME=BLANK-2,      ALIAS=,              FORMAT=D7.2CS,   $
    FIELDNAME=BLANK-3,      ALIAS=,              FORMAT=D7.2CS,   $
    FIELDNAME=BLANK-4,      ALIAS=,              FORMAT=D7.2CS,   $
    FIELDNAME=BLANK-5,      ALIAS=,              FORMAT=D7.2CS,   $
    FIELDNAME=BLANK-6,      ALIAS=,              FORMAT=D7.2CS,   $
    FIELDNAME=BLANK-7,      ALIAS=,              FORMAT=D7.2CS,   $
    FIELDNAME=BLANK-8,      ALIAS=,              FORMAT=D7.2CS,   $
    FIELDNAME=BLANK-9,      ALIAS=,              FORMAT=D7.2CS,   $
    FIELDNAME=BLANK-10,     ALIAS=,              FORMAT=D7.2CS,   $
```

MASTER FILE DEFINITIONS OF FIELDS

Filename DON:

Multisegment File with focus suffix.
Segment Name = Location

Municipality, alias CITY:

2 alphanumeric characters representing each municipality; i.e. EY - East York, VN - Vaughan.

Reach, alias RCH:

2 alphanumeric characters designating each reach.

The first character represents the municipality, thus for example, any given reach in Vaughan has a first character of V.

Outfall Number, alias OUT:

Up to 4 intergers designating an outfall; i.e.
outfall num: 1804.

MO-Number, alias MON:

6 alphanumeric characters reserved for municipal outfall numbers.

Segname Description

Outfall-Type, alias OTYPE:

2 alphanumeric digits representing the type of outfall; i.e. CS - combined sewer overflows, P - pipe.

Pipe-Dim-1, alias SIZE1:

4 integer numbers defining the outfall diameter in inches or, in case of rectangular or oval pipes, the length.

N/A for tribs or ditches.

Pipe-Dim-2, alias SIZE2:

4 integer numbers defining the width of the outfall when necessary.

Description, alias OUTDES:

25 alphanumeric characters used to describe the pipe, usually shape; i.e. circ, square.

Pipe Mat, alias MATERIAL:

3 digit alphanumeric code representing outfall material (i.e. concrete = con).

Segment Name - On-Site

Date: A 6 digit integer code representing the date of the sample. Format is day, month, year (i.e. Aug. 25, 1984: 250884).

Time: A 4 digit integer defining the time of the sample in hours, minutes (i.e. 1.32 pm: 1332).

Last Precip, alias RAIN:

A 3 digit integer representing hours elapsed since last rainfall.

Crew: Two alphanumeric characters representing each crew.

Conductivity, alias CON:

Up to a 5 digit integer number representing conductivity in umhos @ 25°C.

pH: A 3 digit (including 1 decimal place) number representing pH (i.e. 7.2).

Temperature, alias TEMP:

A 3 digit number representing temperature in degrees Celsius (i.e. 32.4°C = 32.4).

RF: An alphanumeric character providing an indication of less than or greater than flow (< = less than, > = greater than). During computation, the value will be treated as =

Flow: Up to a 6 digit number including 3 decimal places used to represent flow at the outfall in litres/second.

Wet-Dry, alias WET:

1 alphanumeric character defining an outfall as either wet, dry or submerged.

Segment Name - Off-Site

Replicant, alias REP:

Up to a number of 3 (1, 2, or 3) representing the replicated data (i.e. if the outfall was sampled 3 times in one visit, the data for that visit will be entered as 3 separate replicates).

RTP: 1 alphanumeric character to allow the entry of ">" "<" to total phosphorus. This field is not considered during computations. Also included are:

RTKN	for	TKN	alias,
RBOD		BOD	
RSS		Suspended Solids	SS
RPNL		Phenols	
RLD		Lead	PB
RZN		Zinc	ZN
RCU		Copper	CU
RCHR		Chrome	
RIR		Iron	FE
RFC		Fecal Coliform	FC
RFS		Fecal Streptococcus	FS

Tot P, alias PHOS:

Up to a 4 digit number with 2 decimal (xxx.dd) represent total phosphorus lab results in mg/L.

Similar treatment for	TKN, Iron	(xxxx.dd)
	Lead, Zinc, Copper, Chrome	(xxxx.ddd)
	BOD	(xxxx.d)
	Suspended Solids	(xxxxxxx)

Phenols:

Up to a 4 digit number with 2 decimal places representing phenol lab results in ug/L.

Fecal Coliform, Fecal Streptococcus:

Up to a 9 digit interger representing the bacterial count in org/100 mL.

Run-No, alias RUN:

2 alphanumeric characters representing the run-no and differentiating between intensive and screening runs (i.e. screening runs indicated as R1, R2, R3; intensive runs indicates as I1, I2, I3).

Blank-2, ... Blank-10:

Extra fields created for new sampling parameters, these fields can be renamed by the rebuild command, or by entering an alias in the Master File description. The format cannot be changed except through rebuild.

EXAMPLES OF TYPICAL EXECUTION FILES

Concentration Averages

```
D:T2.FEX                                  SIZE=17   LINE=0

* * * TOP OF FILE * * *
TABLE FILE DON
WRITE &PAR.PARAMETER?. AND FLOW AND REACH AND MUNICIPALITY
AND COMPUTE BB/D12.2CS =&PAR*FLOW ;
BY OUT BY DATE
ON TABLE HOLD
END
TABLE FILE HOLD
SUM FLOW NOPRINT AND BB NOPRINT
AND COMPUTE CONAVE=SUM.BB/SUM.FLOW ;
AS '&PAR,CONCAVE,MG/L'
BY MUNICIPALITY
BY REACH
ON MUNICIPALITY SUB-TOTAL
IF &PAR GT 0
END

* * * END OF FILE * * *

===>
```

Phys-Chem Data Base

```
D:DP-CP.FEX                               SIZE=19   LINE=0

* * * TOP OF FILE * * *
TABLE FILE DON
PRINT REACH AS 'REACH,,' AND 'OUTFALL NUM' AS 'OUTFALL,NUMBER,'
AND DATE AS 'DATE,,' AND TIME AS 'TIME,,' AND 'LAST PRECIP' AS
'LAST, PRECIP,HRS' AND FLOW AS 'FLOW,,L/S'
AND RTP AS '' AND 'TOT P' AS 'TOT P,,MG/L' IN +0 AND RTKN AS ''
AND TKN AS 'TKN,,MG/L' IN +0
AND RBOD AS '' AND BOD AS 'BOD,,MG/L' IN +0 AND RSS AS ''
AND 'SUSP-SOLIDS AS 'SUSP,SOLIDS,MG/L IN +0
AND RPNL AS ''  AND PHENOLDS AS 'PHENOLS,,UG/L' IN +0
BY MUNICIPALITY PAGE-BREAK  NOPRINT
BY REACH NOPRINT SKIP-LINE
BY OUTFALL NOPRINT SKIP-LINE
IF WET-DRY CONTAINS W
HEADING
"TAWMS DON RIVER DRY WEATHER OUTFALL SURVEY"
"PHYS-CHEM CONCENTRATIONS"
""
""
END
===>
```

Section Concentrations by Parameter

```
DEFINE FILE DON
SECTYPE/I2=IF (REACH CONTAINS 'TA') THEN 1 ELSE
IF (REACH CONTAINS 'TB' OR 'TC')
THEN 2 ELSE IF (REACH CONTAINS 'EA' OR 'TE' OR 'TF' OR 'TD' OR 'TI')
THEN 3 ELSE IF (REACH CONTAINS 'EE' OR 'ED' OR 'EK')
THEN 4 ELSE IF (REACH CONTAINS 'EF' OR 'EG' OR 'SA')
THEN 5 ELSE IF (REACH CONTAINS 'SC' OR 'SB' OR 'SD' OR 'SE')
THEN 6 ELSE IF (REACH CONTAINS 'EH' )
THEN 7 ELSE IF (REACH CONTAINS 'EL' )
THEN 8 ELSE IF (REACH CONTAINS 'NJ' OR 'NK' )
THEN 9 ELSE IF (REACH CONTAINS 'NV' OR 'TH' OR 'TG' )
THEN 10 ELSE IF (REACH CONTAINS 'NM' OR 'NN' OR 'NO')
THEN 11 ELSE IF (REACH CONTAINS 'NQ' OR 'NP' OR 'NW' )
THEN 12 ELSE 0 ;
BY DATE
BY 'OUTFALL NUM'
BY REACH
BY SECTYPE
IF &PAR GT 0
IF FLOW GT 0
ON TABLE HOLD
END
TABLE FILE HOLD
SUM BB AND FLOW AND CNT FLOW
AND COMPUTE LOADAVE=SUM.BB/CNT.FLOW ;
AND COMPUTE FLOWAVE=SUM.FLOW/CNT.FLOW ;
BY 'OUTFALL NUM'
BY REACH
BY SECTYPE
ON TABLE HOLD AS TOM
END
TABLE FILE TOM
SUM LOADAVE AND FLOWAVE
AND COMPUTE AVECONC=SUM.LOADAVE/SUM.FLOWAVE ;
BY SECTYPE AS 'SECTION NUMBER'
IF SECTYPE EQ &TO.ENTER SECTION NUMBER BETWEEN 1 OR 12.
PRINT AVECONC AS 'AVERAGE,CONCENTRATION ,MG/L,'
HEADING
"TAWMS DON RIVER DRY WEATHER OUTFALL SURVEY"
"&PAR CONCENTRATION AVERAGES BY SECTION NUMBER"
""

END
```

Section Concentrations by Parameter (cont'd)

```
DEFINE FILE DON
SECTYPE/I2=IF (REACH CONTAINS 'NT' OR 'NS' OR 'NR') THEN 13 ELSE
IF (REACH CONTAINS 'VA' OR 'VB' OR 'VD' )
THEN 14 ELSE IF (REACH CONTAINS 'VE' OR 'VF' OR 'VG' OR 'VM' )
THEN 15 ELSE IF (REACH CONTAINS 'NC' OR 'NB' OR 'NX' OR 'EI' OR 'EJ' )
THEN 16 ELSE IF (REACH CONTAINS 'NG' OR 'NU' OR 'NF' OR 'NE' OR 'ND')
THEN 17 ELSE IF (REACH CONTAINS 'NH' OR 'NY' )
THEN 18 ELSE IF (REACH CONTAINS 'NI' )
THEN 19 ELSE IF (REACH CONTAINS 'MD' OR 'ME' OR 'VH' )
THEN 20 ELSE IF (REACH CONTAINS 'RE' OR 'RF' OR 'RD' OR 'MB' OR 'MA' )
THEN 21 ELSE IF (REACH CONTAINS 'RA' OR 'RB' OR 'RH' OR 'VJ' OR 'VK'
OR 'RC' OR 'RG' OR 'VP' )
THEN 22 ELSE 0 ;
END
TABLE FILE DON
WRITE &PAR.PARAMETER. AND FLOW
AND COMPUTE BB/D12.2CS=&PAR*FLOW ;
BY DATE
BY 'OUTFALL NUM'
BY REACH
BY SECTYPE
IF &PAR GT 0
IF FLOW GT 0
IF 'OUTFALL NUM' NE 234
ON TABLE HOLD
END
TABLE FILE HOLD
SUM BB AND FLOW AND CNT FLOW
AND COMPUTE LOADAVE=SUM.BB/CNT.FLOW ;
AND COMPUTE FLOWAVE=SUM.FLOW/CNT.FLOW ;
BY 'OUTFALL NUM'
BY REACH
BY SECTYPE
ON TABLE HOLD AS TOM
END
TABLE FILE TOM
SUM LOADAVE AND FLOWAVE
AND COMPUTE AVECONC=SUM.LOADAVE/SUM.FLOWAVE ;
BY SECTYPE AS 'SECTION NUMBER'
IF SECTYPE EQ &TO.ENTER SECTION NUMBER BETWEEN 13 OR 22.
PRINT AVECONC AS 'AVERAGE,CONCENTRATION,MG/L,'
HEADING
"TAWMS DON RIVER DRY WEATHER OUTFALL SURVEY"
"&PAR LOAD AND CONCENTRATION AVERAGES BY SECTION NUMBER"
""

END
```

Load Averages by Parameter

```
TABLE FILE DON
PRINT REACH AND &DATA1.MUNICIPALITY OR REACH?. AND 'OUTFALL NUM' AND
&PARA.PARAMETER?.
AND REACH
AND COMPUTE BB/D12.2CS=AVE.&PARA*FLOW*1.44*60 ;
BY 'OUTFALL NUM' BY DATE
IF '&PARA' GT 0
ON TABLE HOLD
END
TABLE FILE HOLD
SUM BB NOPRINT AND CNT BB NOPRINT
AND COMPUTE LOADAVE =SUM.BB/CNT.BB ;
BY 'OUTFALL NUM'
BY &DATA1
ON TABLE HOLD AS NEWDON
END
TABLE FILE NEWDON
PRINT 'OUTFALL NUM' AS 'OUTFALL,NUMBER' AND 'LOADAVE' AS 'LOADAVE,GM/D
BY &DATA1 PAGE-BREAK
BY HIGHEST LOADAVE NOPRINT
HEADING
"&PARA LOAD AVERAGES "
""
""
END
```

APPENDIX IV

QUALITY ASSURANCE DATA

1) Variance Attributable to Sampling

2) Differences Between Laboratories for Conventional Parameters and Heavy Metals

3) Inter-Laboratory Comparison of Bacteriological Analyses

VARIANCE ATTRIBUTABLE TO SAMPLING

FIGURE NO.	PARAMETER	LINEAR REGRESSION EQUATION	CORRELATION COEFFICIENT
IV-1	BOD	y = 0.94 x - 0.07	r = 0.99
IV-2	SS	y = 1.04 x - 0.89	r = 0.98
IV-3	Total P	y = 1.00 x + 0.03	r = 0.81
IV-4	TKN	y = 0.97 x - 0.03	r = 0.99
IV-5	Zinc	y = 1.03 x - 0.003	r = 0.99
IV-6	Lead	y = 1.17 x - 0.01	r = 0.93
IV-7	Copper	y = 1.05 x - 0.0003	r = 1.00
IV-8	Chromium	y = 1.00 x - 0.0007	r = 1.00
IV-9	Iron	y = 1.36 x - 0.12	r = 0.93

<u>Note:</u> y = Replicate 2
x = Replicate 1

Both replicates analyzed by same laboratory

DIFFERENCES BETWEEN LABORATORIES FOR CONVENTIONAL PARAMETERS AND HEAVY METALS

FIGURE NO.	PARAMETER	LINEAR REGRESSION EQUATION	CORRELATION COEFFICIENT
IV-10	BOD	y = 1.04 x + 0.27	r = 0.88
IV-11	SS	y = 0.68 x - 0.06	r = 0.99
IV-12	Total P	y = 1.00 x + 0.01	r = 0.92
IV-13	TKN	y = 0.78 x - 0.07	r = 0.94
IV-14	Zinc	y = 0.87 x - 0.004	r = 0.90
IV-15	Lead	y = 0.14 x + 0.06	r = 0.11
IV-16	Copper	y = 0.07 x - 0.007	r = 0.28
IV-17	Chromium	y = 1.01 x + 0.004	r = 0.95
IV-18	Iron	y = 0.78 x + 0.25	r = 0.84

<u>Note:</u> y = Analyzed by IEC Beak
x = Analyzed by MOE

No assessment of phenols was carried out due to the limited number of observations.

LIST OF FIGURES

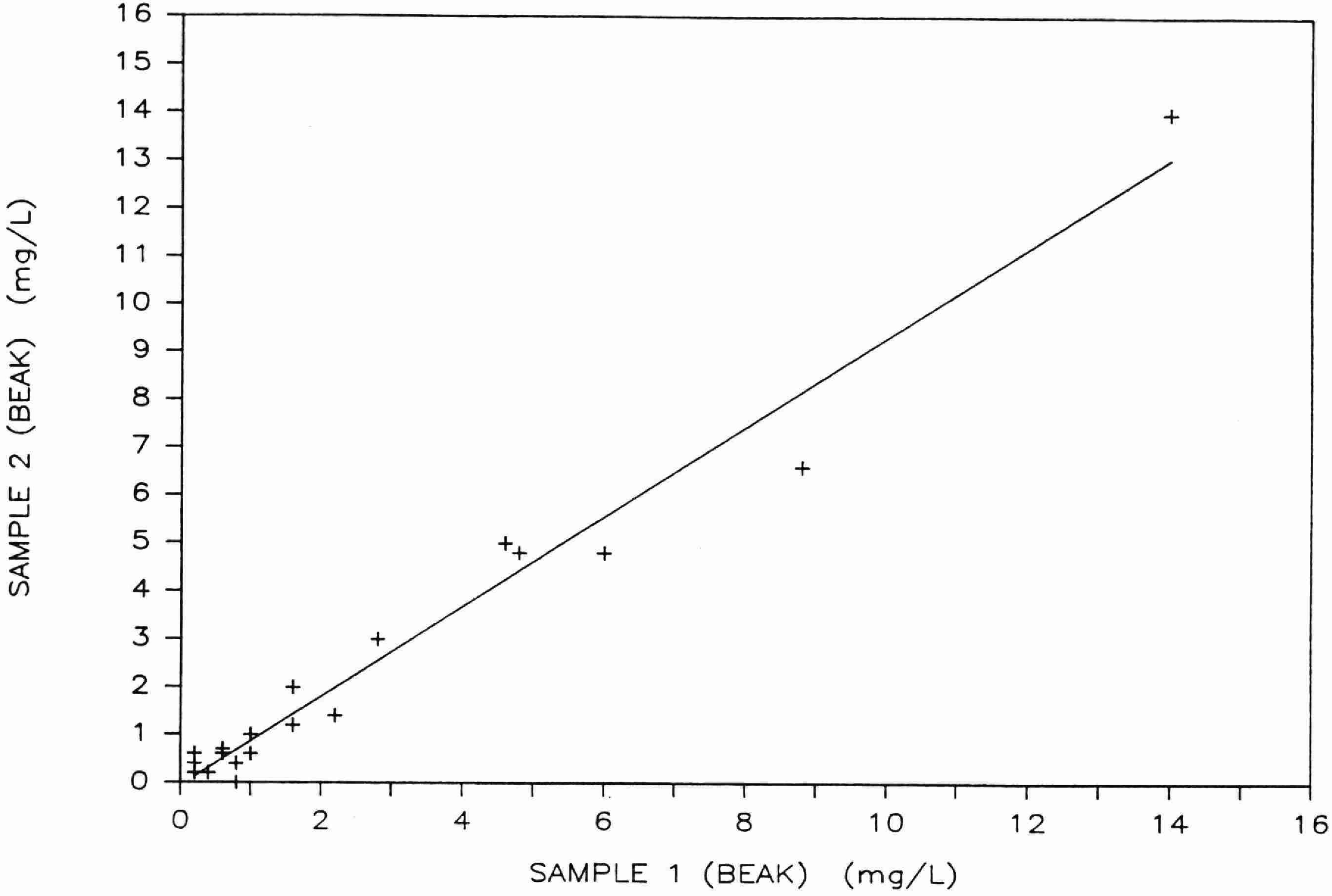


FIGURE IV-1. ANALYSIS OF SAMPLING VARIANCE OF BIOCHEMICAL OXYGEN DEMAND (BOD)

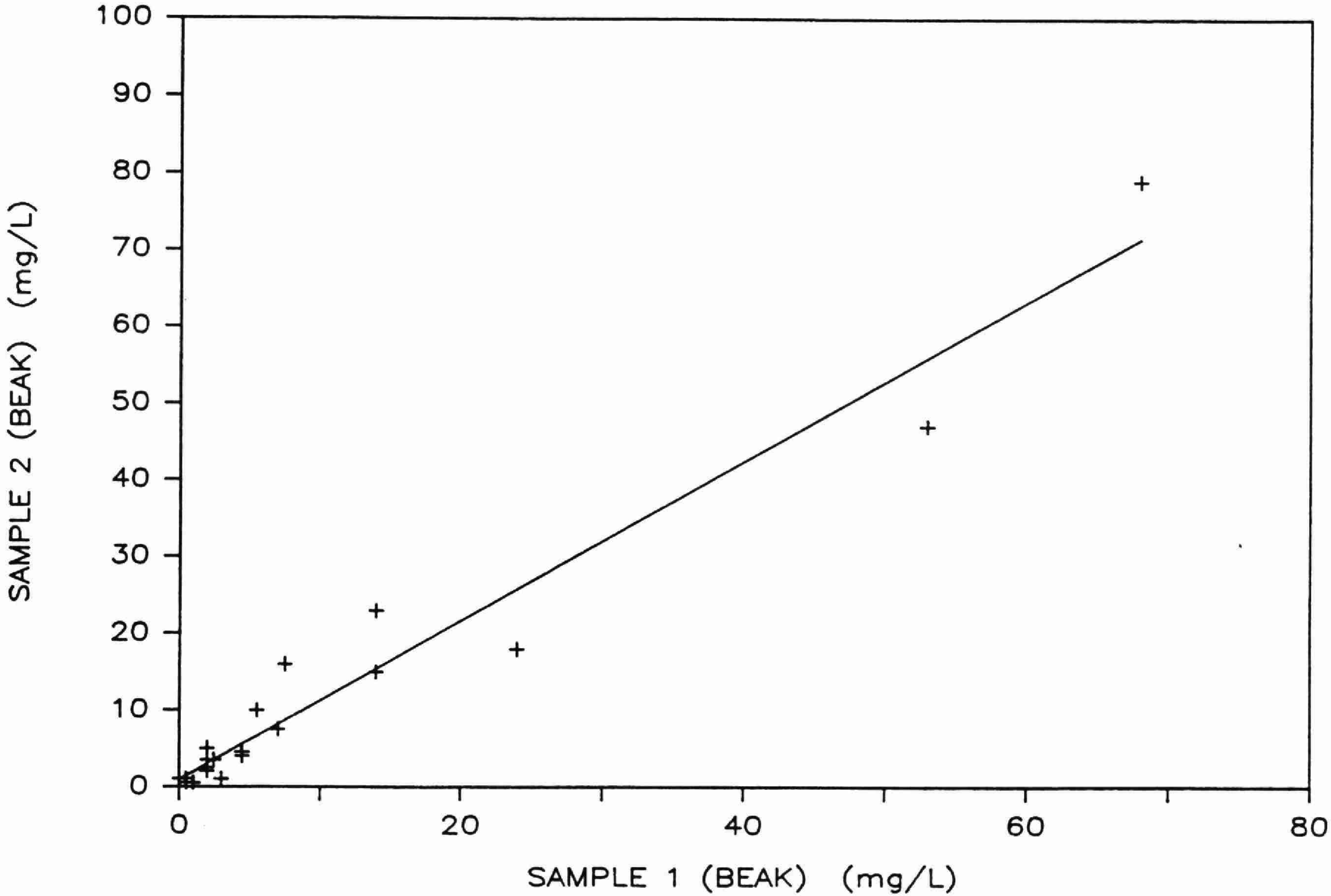


FIGURE IV-2. ANALYSIS OF SAMPLING VARIANCE OF SUSPENDED SOLIDS

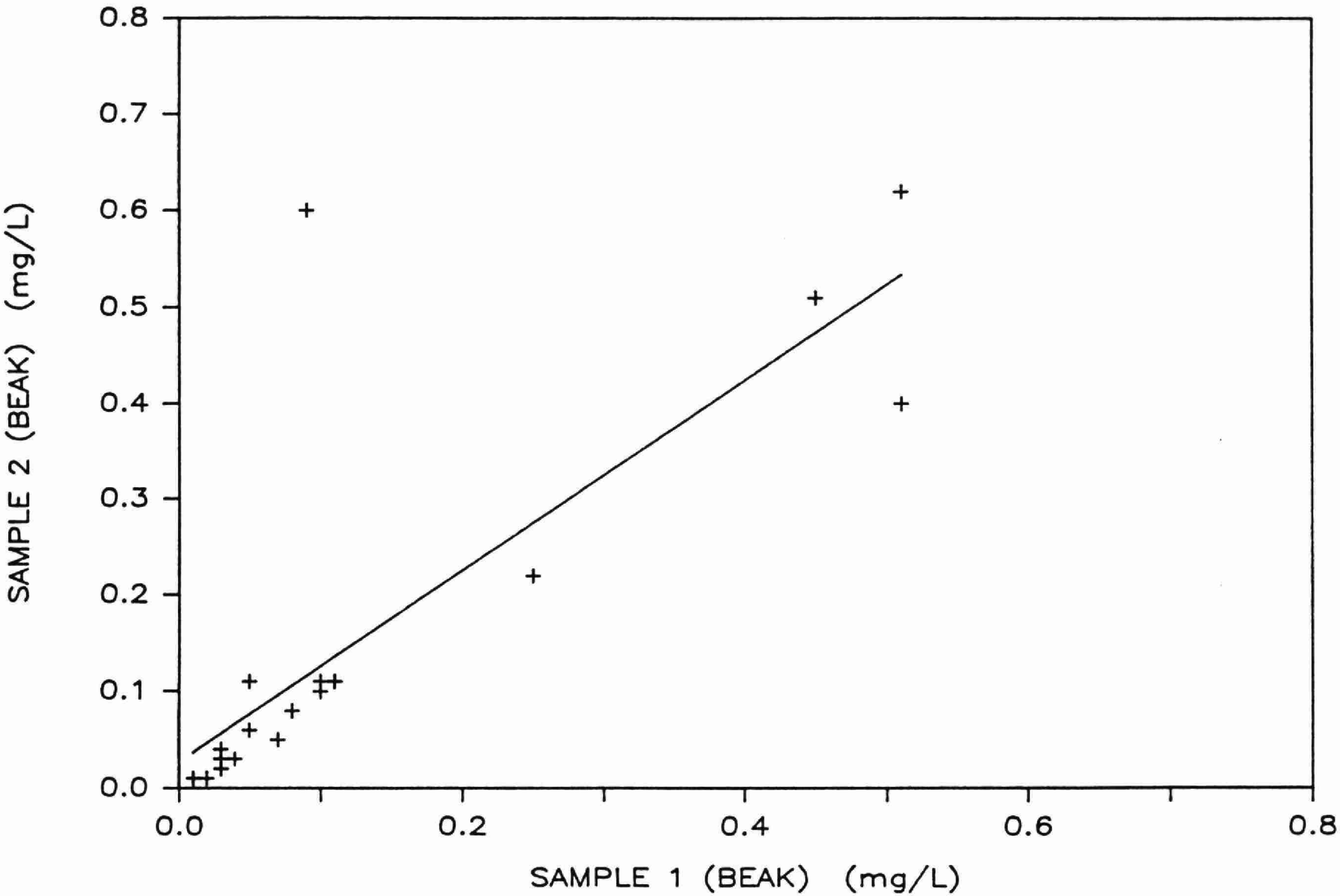


FIGURE IV-3. ANALYSIS OF SAMPLING VARIANCE OF TOTAL PHOSPHORUS

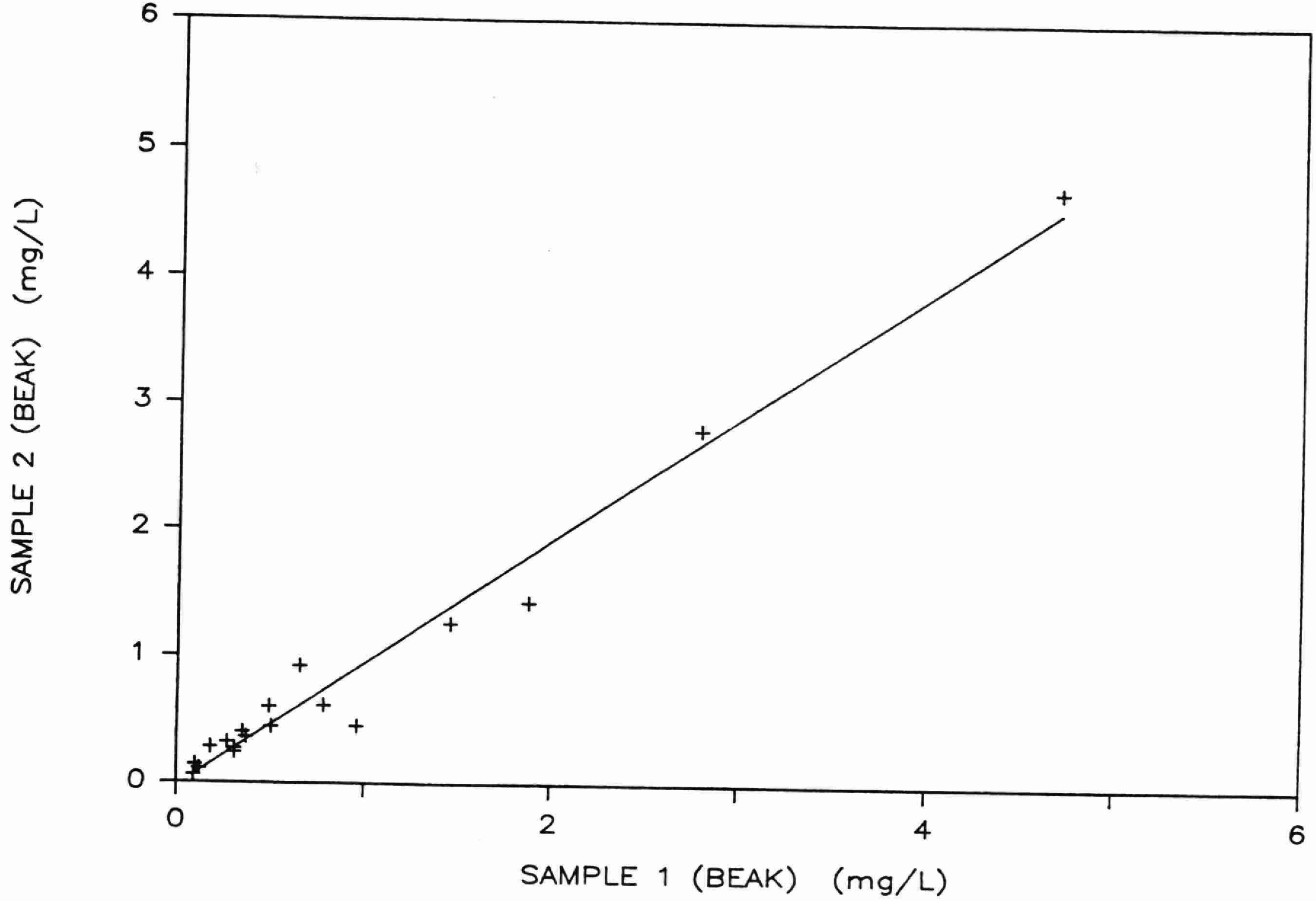


FIGURE IV-4. ANALYSIS OF SAMPLING VARIANCE OF TOTAL KJELDAHL NITROGEN (TKN)

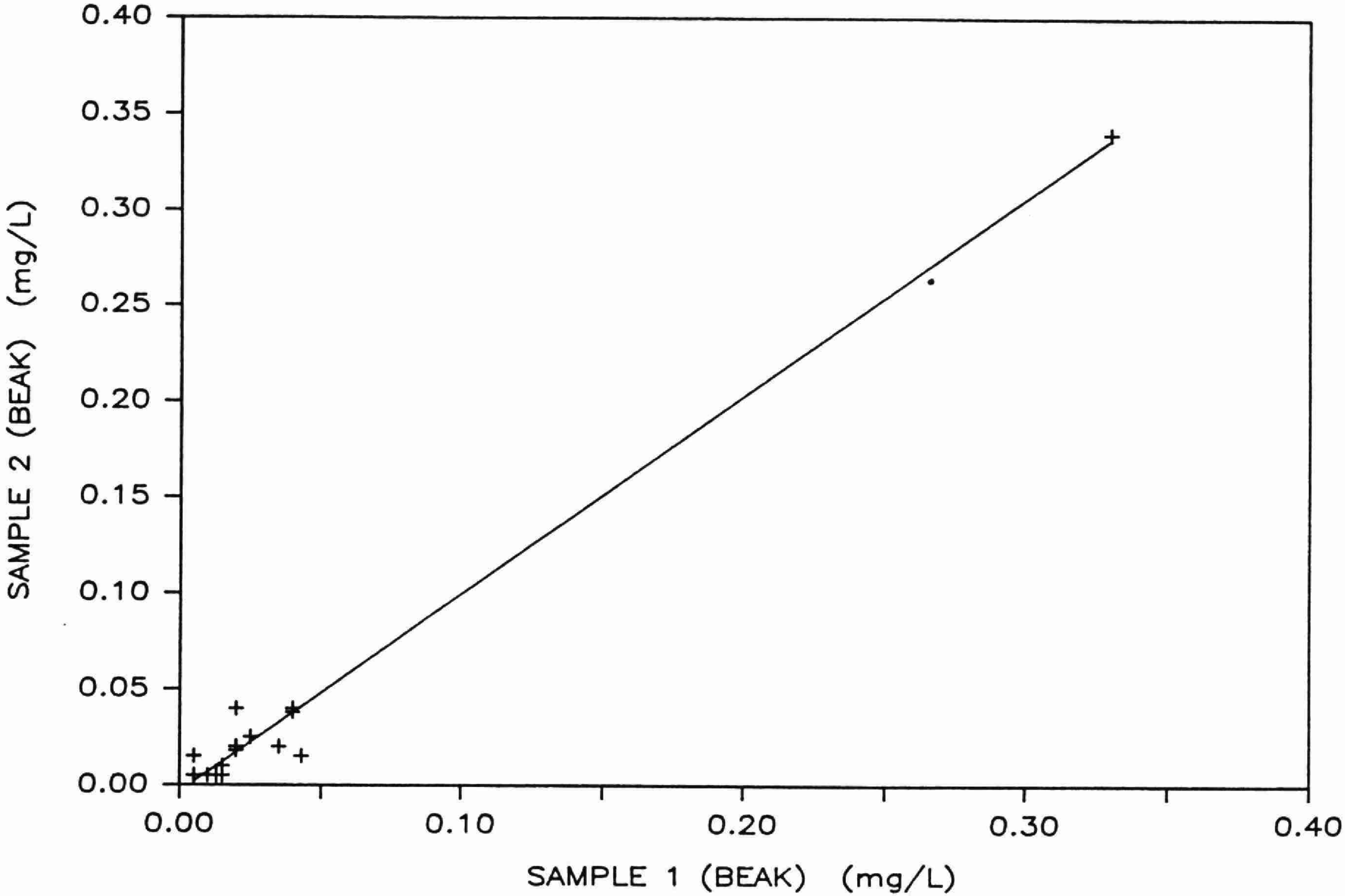


FIGURE IV-5. ANALYSIS OF SAMPLING VARIANCE OF ZINC

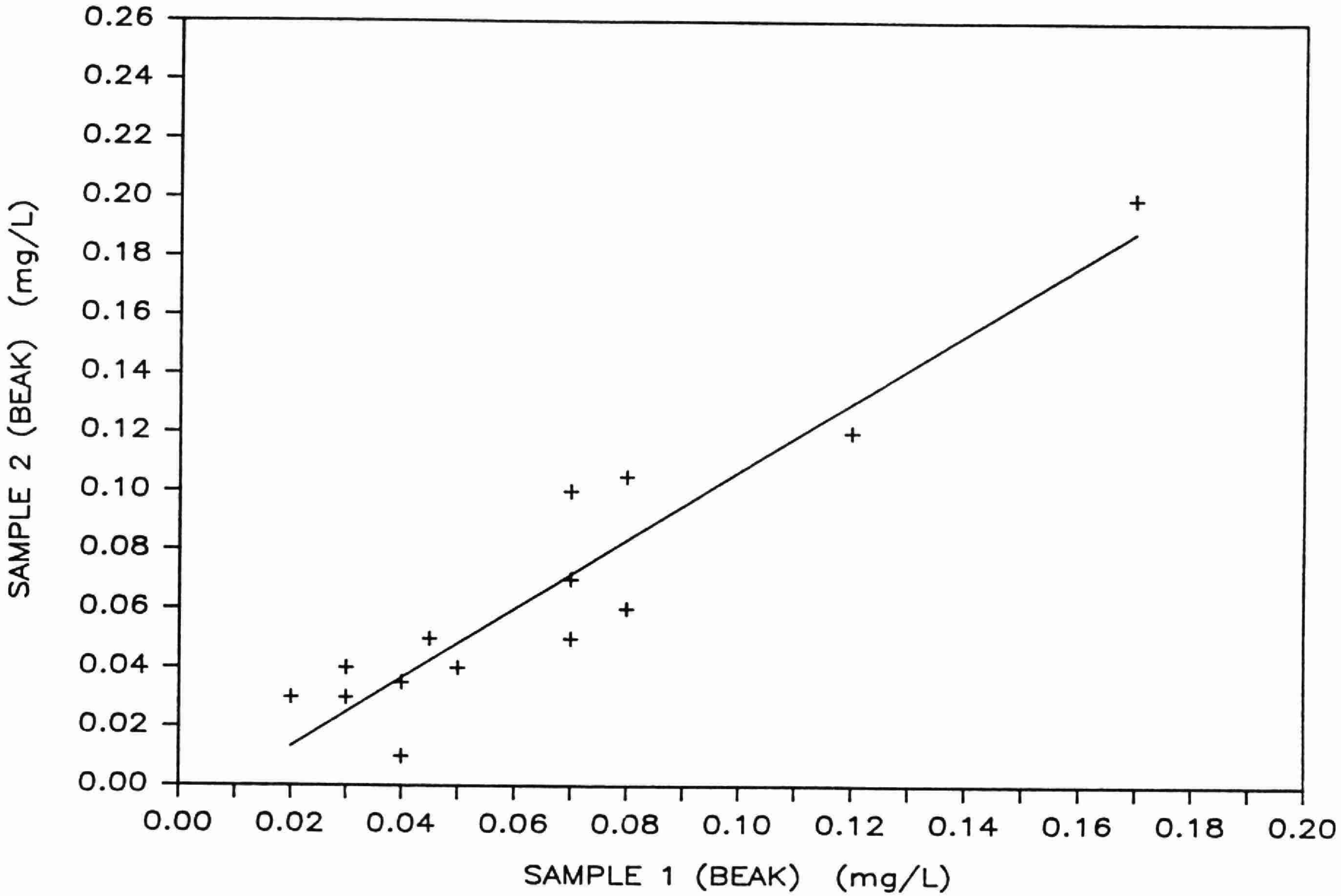


FIGURE IV-6. ANALYSIS OF SAMPLING VARIANCE OF LEAD

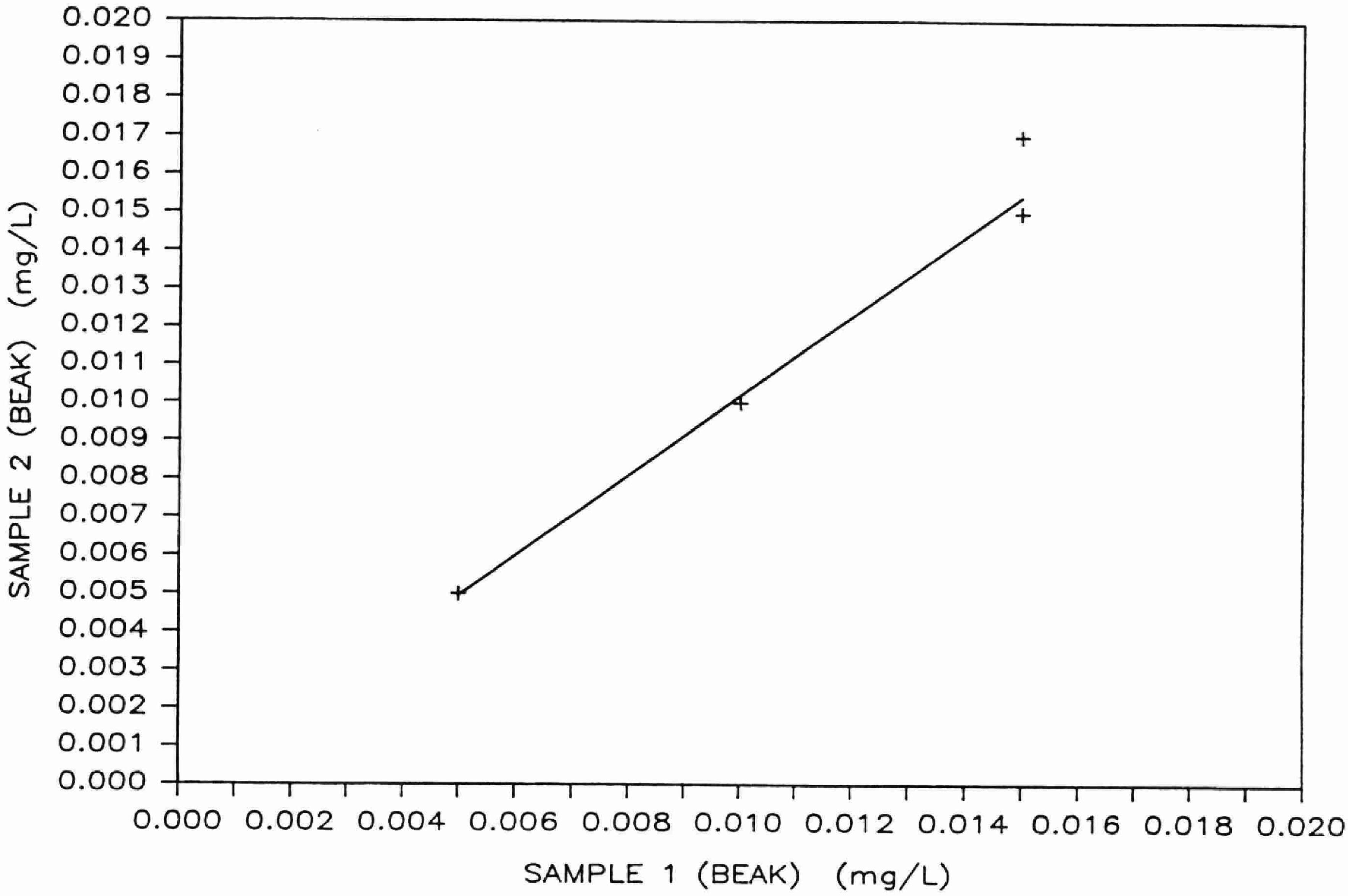


FIGURE IV-7. ANALYSIS OF SAMPLING VARIANCE OF COPPER

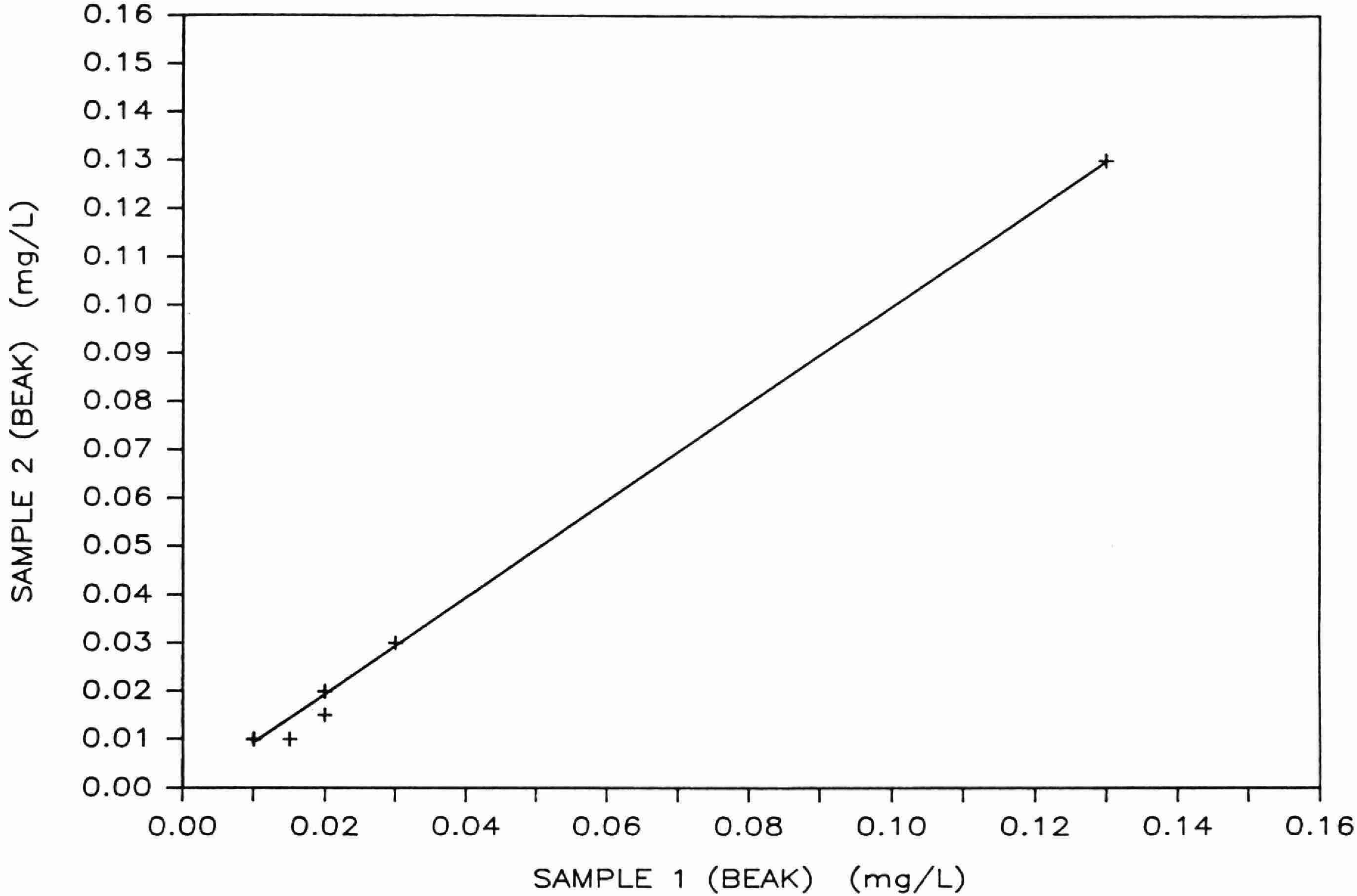


FIGURE IV-8. ANALYSIS OF SAMPLING VARIANCE OF CHROMIUM

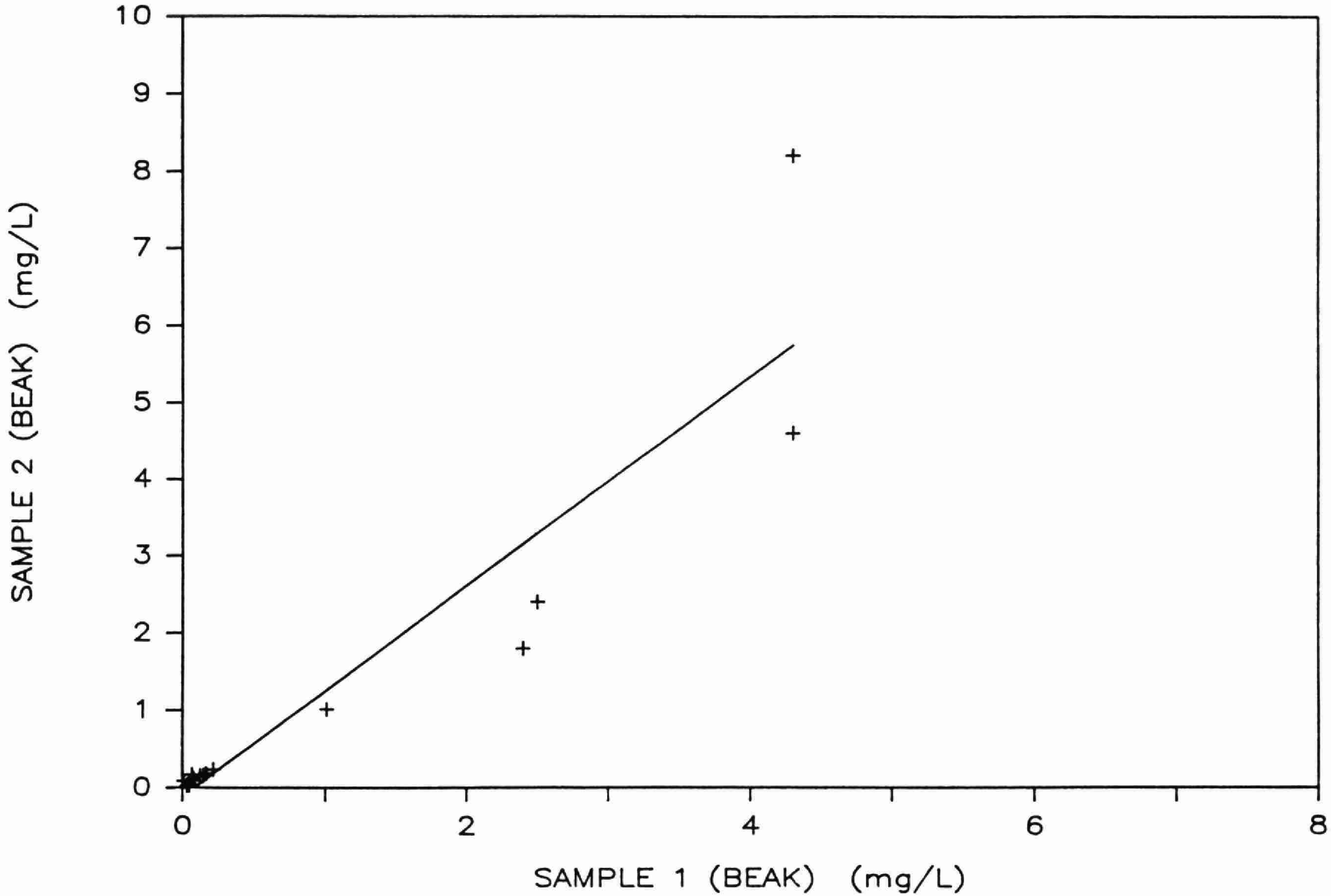


FIGURE IV-9. ANALYSIS OF SAMPLING VARIANCE OF IRON

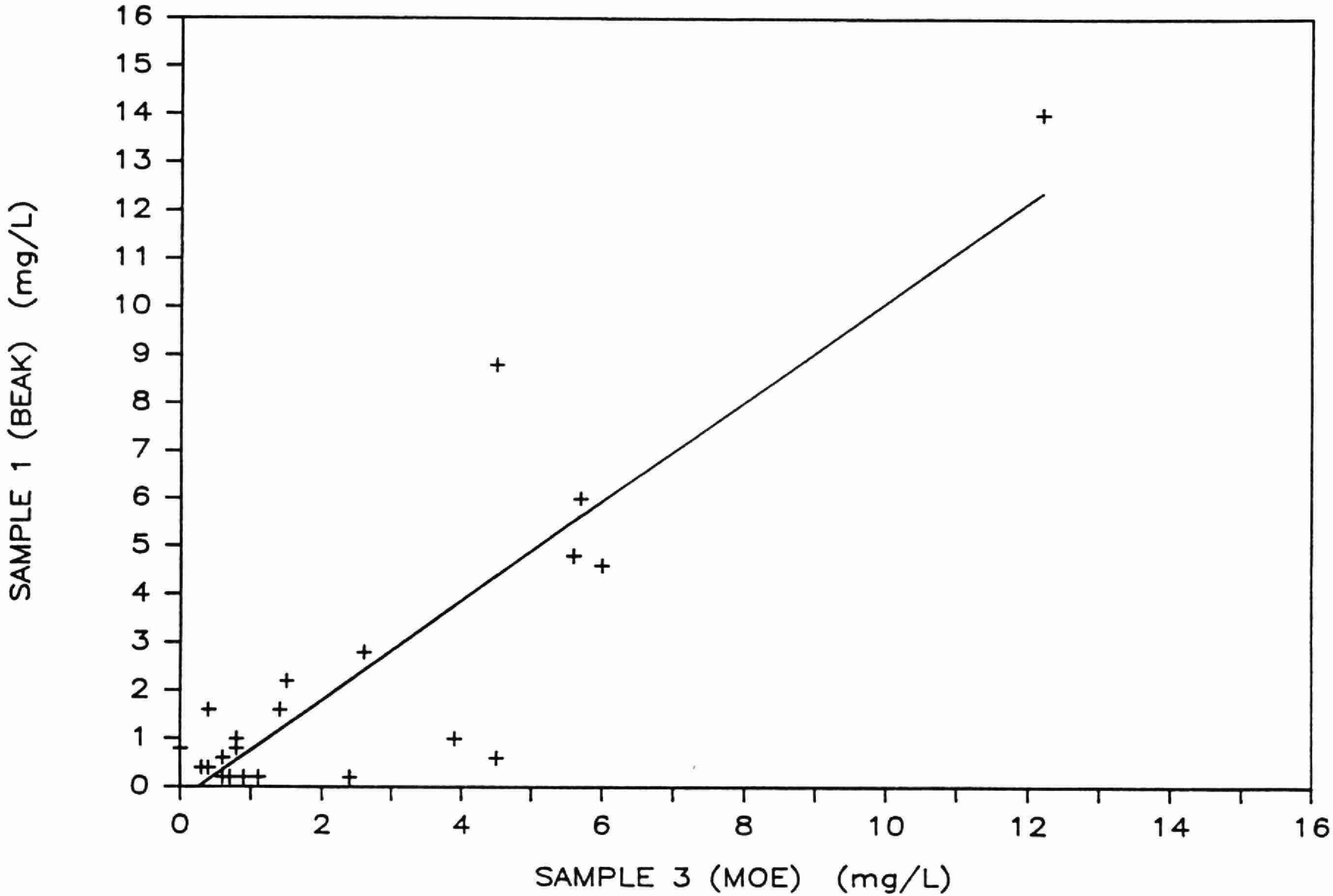


FIGURE IV-10. ANALYSIS OF ANALYTICAL VARIANCE OF BIOCHEMICAL OXYGEN DEMAND (BOD)

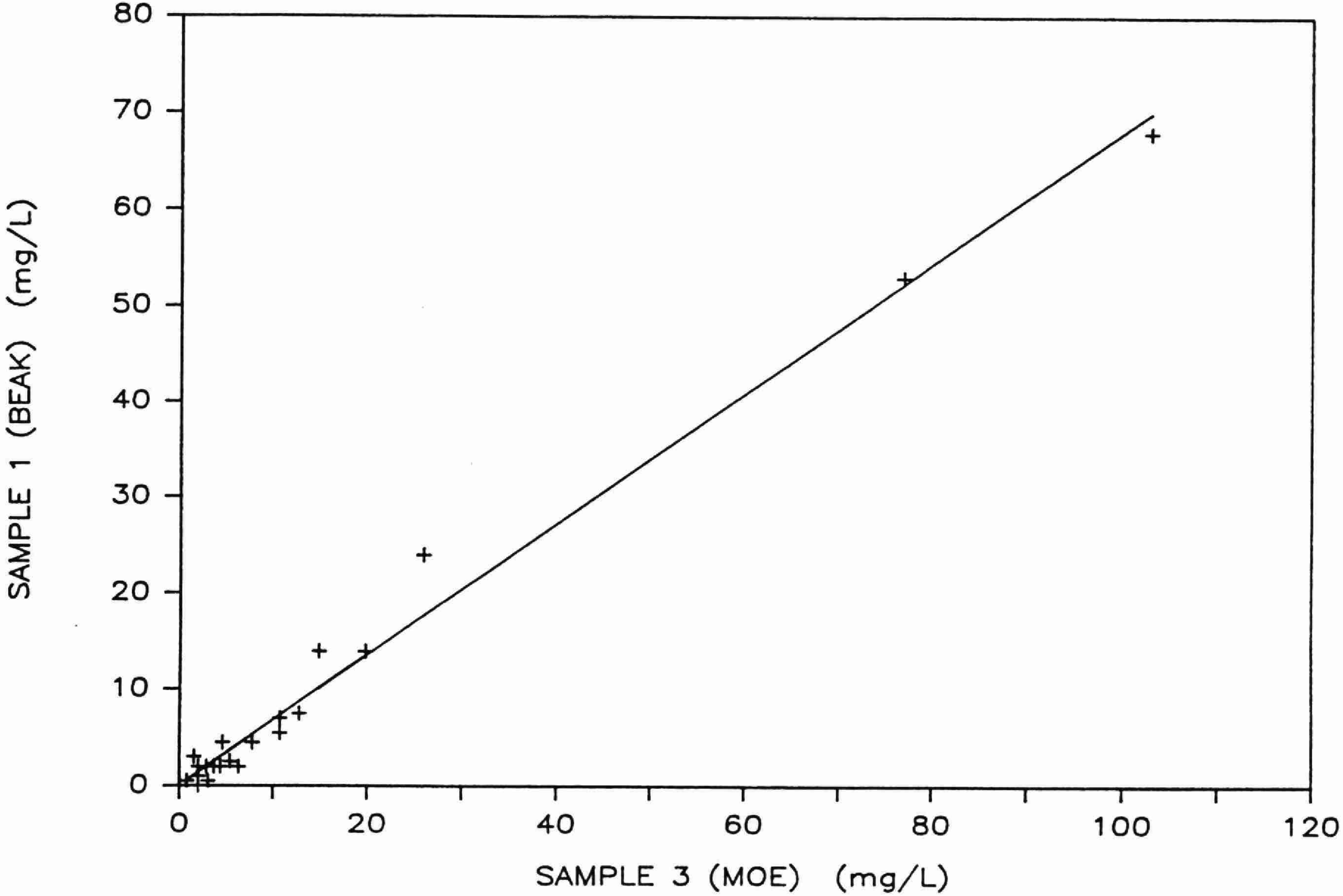


FIGURE IV-11. ANALYSIS OF ANALYTICAL VARIANCE OF SUSPENDED SOLIDS

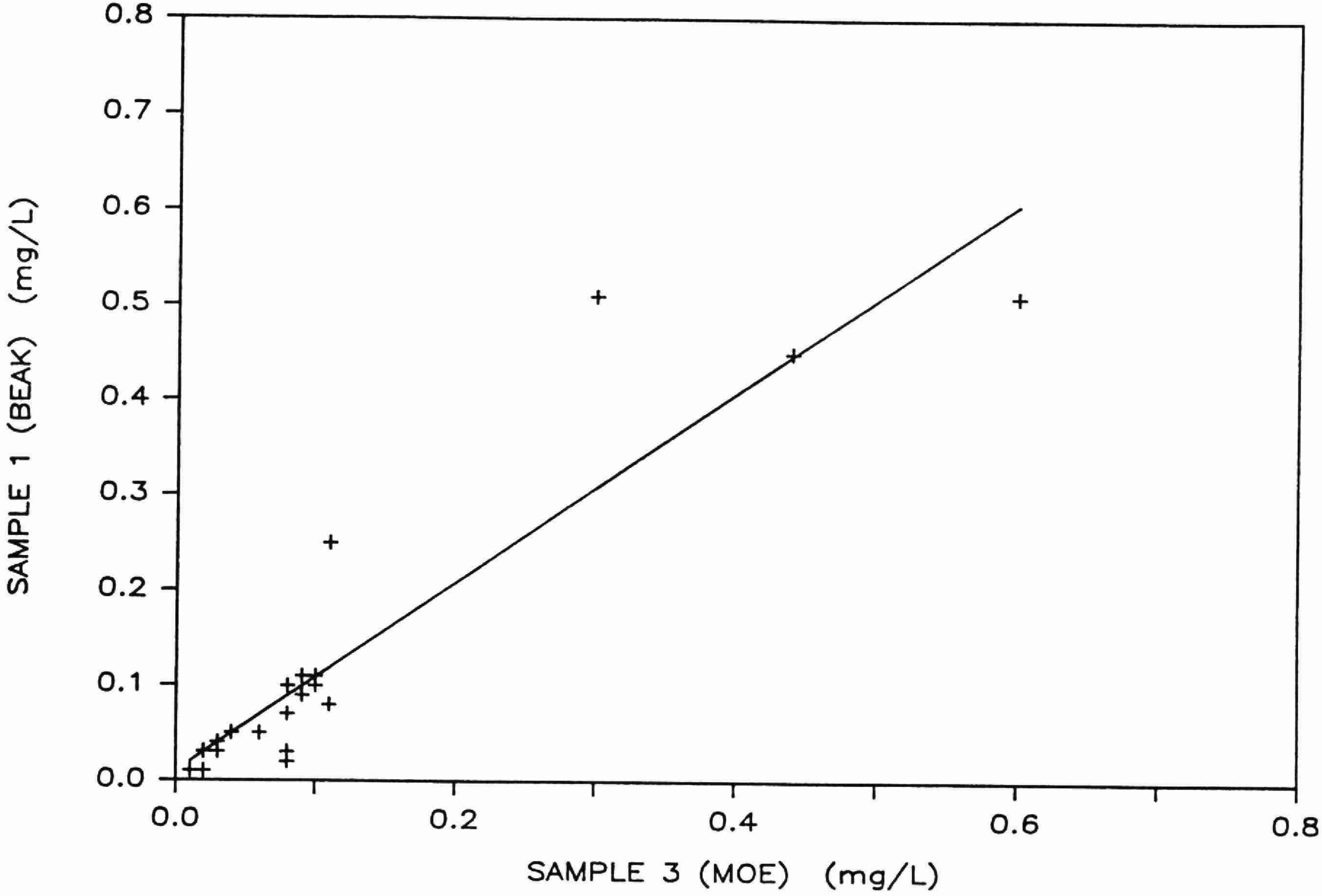


FIGURE IV-12. ANALYSIS OF ANALYTICAL VARIANCE OF TOTAL PHOSPHORUS

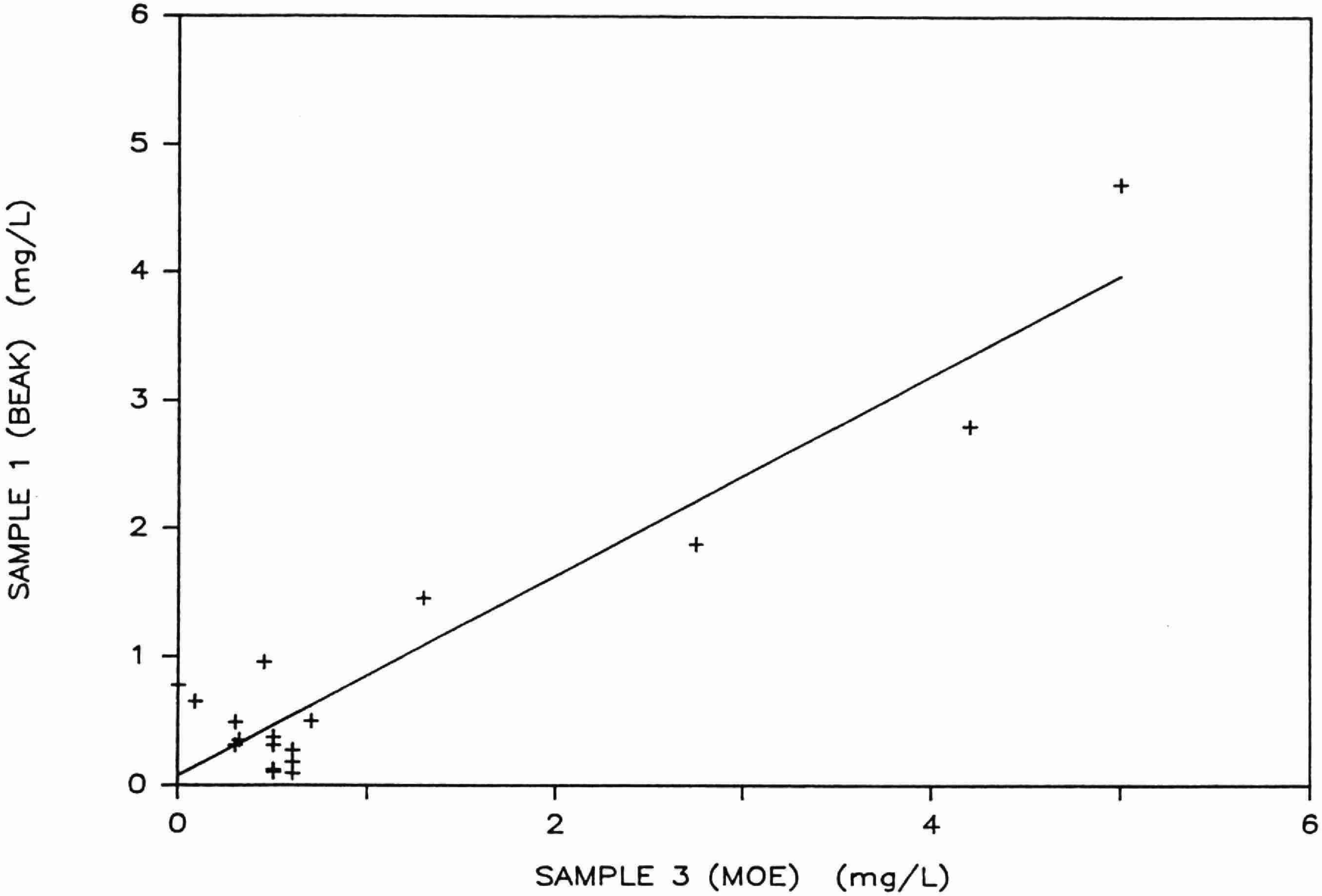


FIGURE IV-13. ANALYSIS OF ANALYTICAL VARIANCE OF TKN

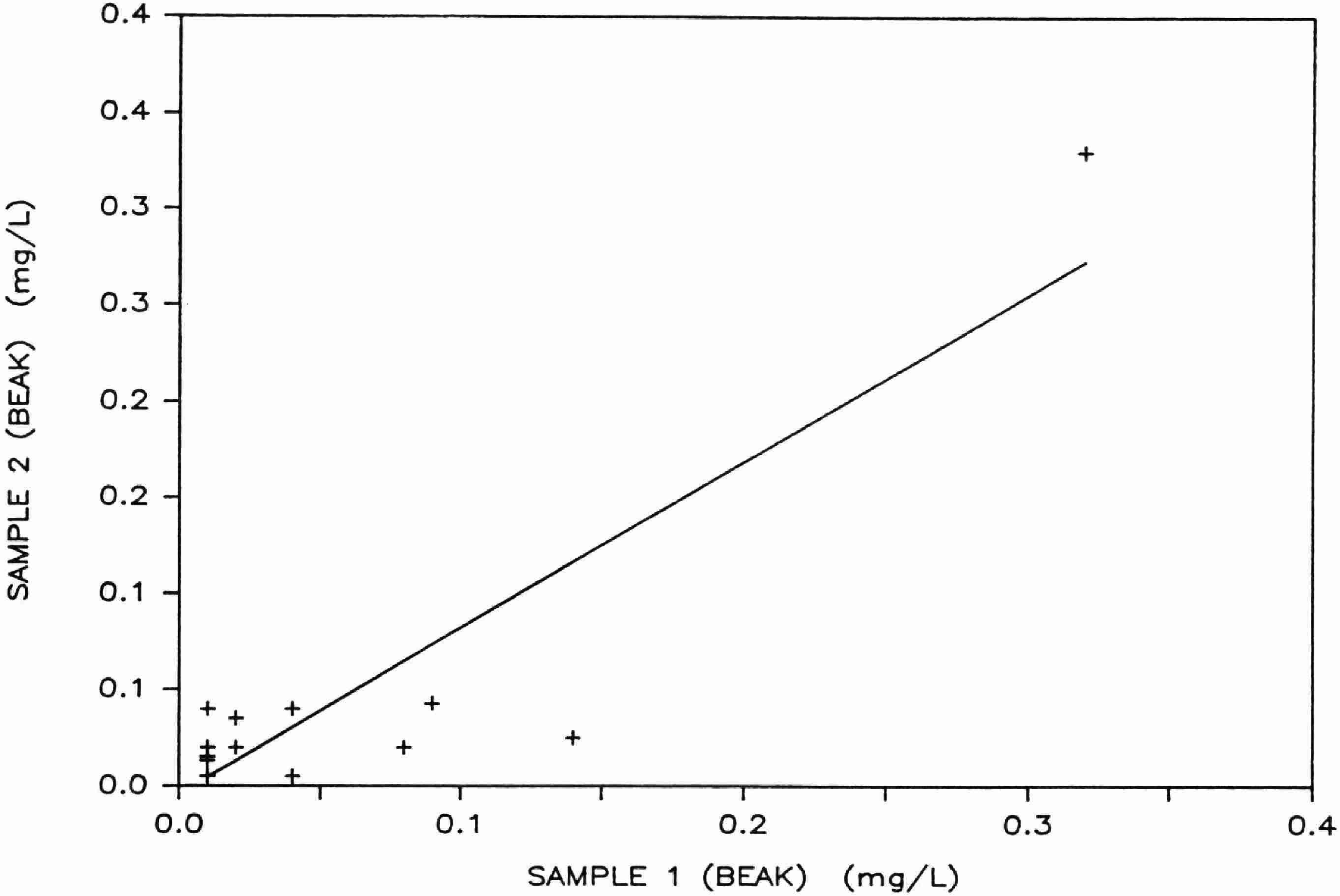


FIGURE IV-14. ANALYSIS OF ANALYTICAL VARIANCE OF ZINC

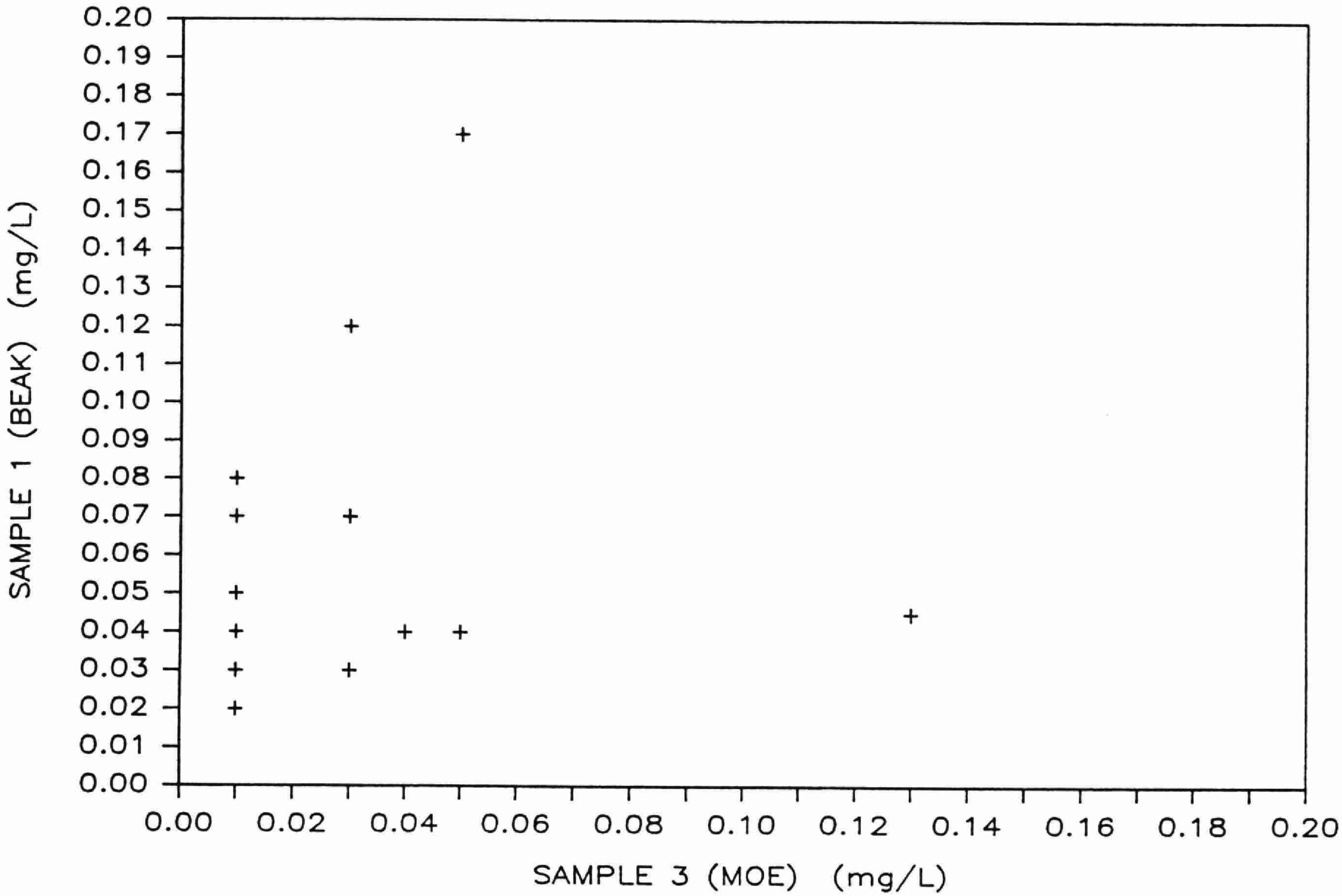


FIGURE IV-15. ANALYSIS OF ANALYTICAL VARIANCE OF LEAD

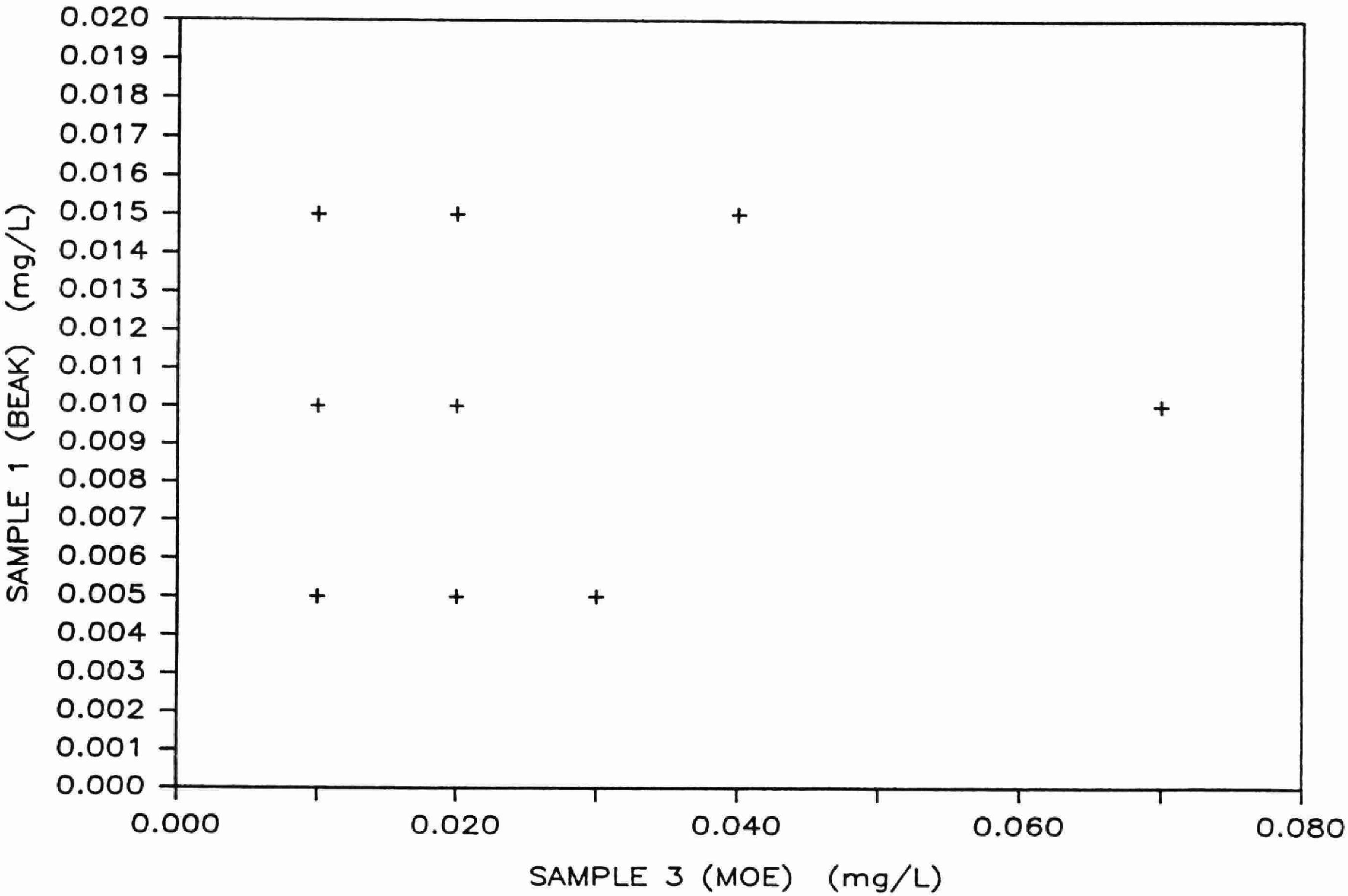


FIGURE IV-16. ANALYSIS OF ANALYTICAL VARIANCE OF COPPER

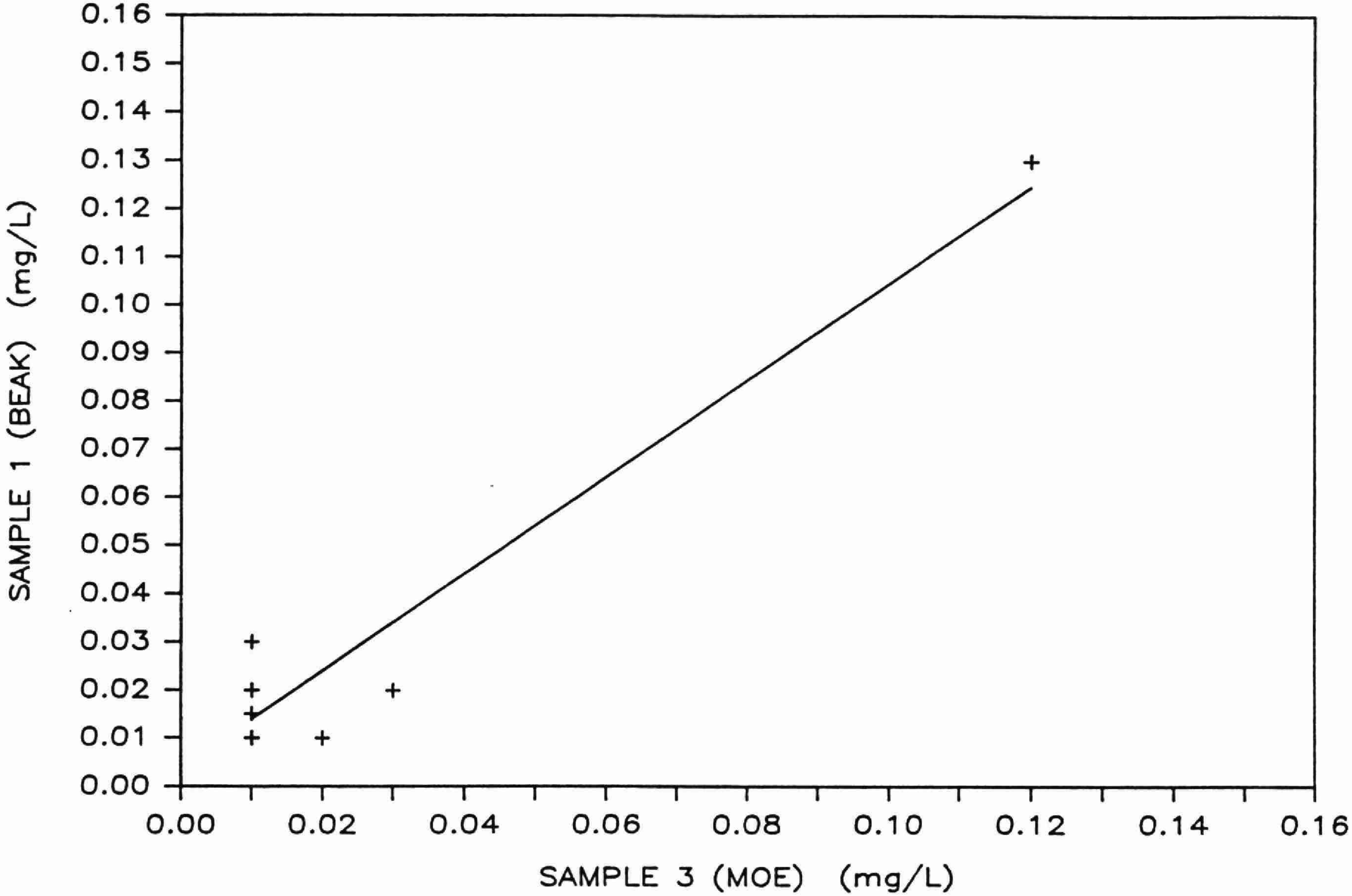


FIGURE IV-17. ANALYSIS OF ANALYTICAL VARIANCE OF CHROMIUM

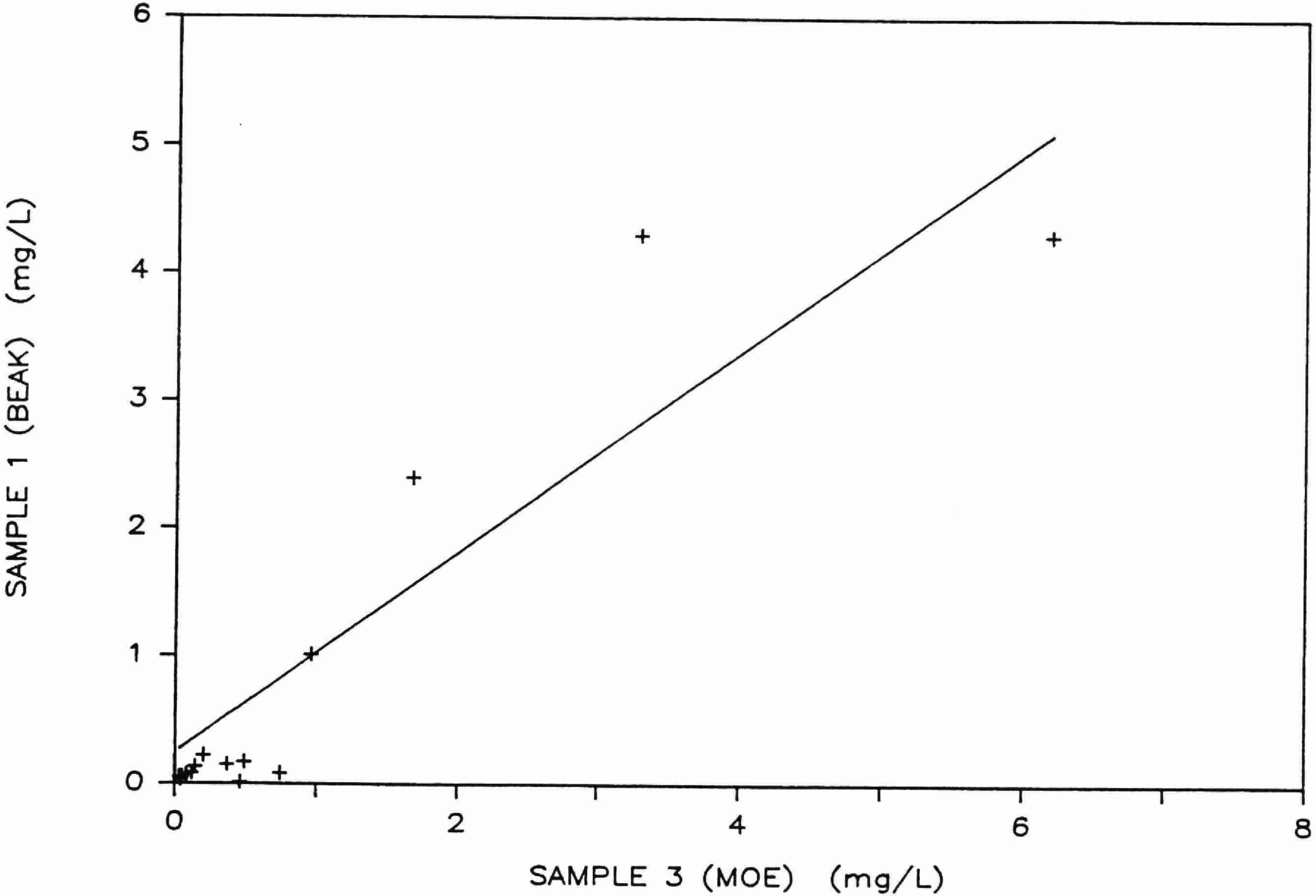


FIGURE IV-18. ANALYSIS OF ANALYTICAL VARIANCE OF IRON

INTERLAB COMPARISON OF FECAL COLIFORM AND FECAL STREPTOCOCCUS RESULTS (MOE AND YOUNG AND ASSOCIATES LABORATORIES)

PARAMETER	LAB	REP	RAW DATA (org/filter)					GROUP STATISTIC	CONCLUSION AT .05
			1	2	3	4	5		
Fecal Coliform	MOE	1	5	9	3	5	5	x = 2.089	No Significant Difference
		2	4	2	5	2	6	S^2 = .3636	
		3	7	2	6	6	2	N = 15	
								RMS = 4.4	
	Young & Assoc.	1	6	8	6	4	4	x = 3.32	
		2	9	9	3	2	9	S^2 = .3938	
		3	10	5	7	2	2	N = 15	
								RMS = 5.4	
Fecal Streptococcus	MOE	1	15	13	12	7	12	x = 3.22	No Significant Difference
		2	11	5	14	12	12	S^2 = .225	
		3	9	2	6	10	9	N = 15	
								RMS = 10.4	
	Young & Assoc.	1	12	10	14	14	9	x = 3.41	
		2	12	13	12	12	16	S^2 = .117	
		3	8	12	14	9	9	N = 15	
								RMS = 4.4	

APPENDIX V

SUMMARY OF OUTFALL INVENTORY BY REACH

1) Summary of Outfall Inventory by Reach
2) Summary of Outfall Sampling by Reach
3) Summary of Average Outfall Discharge by Reach

TABLE V-1. SUMMARY OF OUTFALL INVENTORY BY REACH

REACH	WET PIPES	DRY PIPES	SUBMERGED PIPES	WET CSO	DRY CSO	SUBMERGED CSO	WET TRIB	DRY TRIB	SUBMERGED TRIB	WET DITCH	DRY DITCH	SUBMERGED DITCH	TOTAL
EA	6	11							1				18
ED	6	2		1									9
EE		1											1
EF	10	6					1						17
EG	38	13		1		1	1						54
EH	16	18					1	1			5		41
EI	1						1						2
EJ	1	1						1					3
EK	9	11	1										21
EL	1	5											6
TOTAL	88	68	1	2		1	4	2	1		5		172
MA	19	13					1						33
MB	3	6											9
MD	17	24	2					4			5		52
ME	20	17	2				4	2		1	7		53
TOTAL	59	60	4				5	6		1	12		147
NB	15	10					1	1					27
NC	19	20					1	1					41
ND	19	14	1				1						35
NE	3	4	2										9
NF	12	2					1	2					17
NG	13	7	1				7	5					33
NH	9	5					1	1					16
NI	9	5					1			1	2		18
NJ	10	10	1				3	2					26
NK	13	6	2				2						23
NM	9	3					4	1					17
NN	15	19	2				3						39

TABLE V-1 (CONT'D). SUMMARY OF OUTFALL INVENTORY BY REACH

REACH	WET PIPES	DRY PIPES	SUBMERGED PIPES	WET CSO	DRY CSO	SUBMERGED CSO	WET TRIB	DRY TRIB	SUBMERGED TRIB	WET DITCH	DRY DITCH	SUBMERGED DITCH	TOTAL
NO	8	15					1						24
NP	10	11	1				1						23
NQ	12	15					2	2			2		33
NR	15	7	1				1				1		25
NS	8	5	1				1				3		18
NT	9		1										10
NU	14	6						2					22
NV	3	6					7						16
NW	5	12											17
NX	9	3											12
NY	7	8											15
TOTAL	246	193	13				38	17		1	8		516
RA	1	8	1					2			1		13
RB	3	1					3	1		1			9
RC	12	8	4				1	5			10		40
RD	6	9									6		21
RE	5	8	2				1	4		1	2		23
RF	8	2						1					11
RG	9	15					5	4		1	6		40
RH	1		1				1						3
TOTAL	45	51	8				11	17		3	25		160
SA	12	17		6	1			1			3		40
SB	19	31			1					1	2		54
SC	25	48								1	9		83
SD	8	6									1		15
SE	8	6											14
TOTAL	72	108		6	2			1		2	15		206

TABLE V-1 (CONT'D). SUMMARY OF OUTFALL INVENTORY BY REACH

REACH	WET PIPES	DRY PIPES	SUBMERGED PIPES	WET CSO	DRY CSO	SUBMERGED CSO	WET TRIB	DRY TRIB	SUBMERGED TRIB	WET DITCH	DRY DITCH	SUBMERGED DITCH	TOTAL
TA				1									1
TB	6	2		5	4								17
TC	2	1		7	1						2		13
TD		1	3							2			6
TE	2	6											8
TF	15	6											21
TG	7	5	2										14
TH	2												2
TI	4			1									5
TOTAL	38	21	5	14	5					2	2		87
VA	10	10	2				1				3		26
VB							1						1
VD	9	10					2			1	2		24
VE	1	2											3
VF	1									1			2
VG	3	4						1					8
VH	8	4	3				1	1			1		18
VJ	2	2					2				2		8
VK	2										4		6
VM	3	5					1			2	4		15
VP	1	3											4
TOTAL	40	40	5				8	2		4	16		115

TABLE V-2. SUMMARY OF OUTFALL SAMPLING BY REACH

REACH	ONCE STORM SEWER OUTFALL	TWICE STORM SEWER OUTFALL	ONCE COMB. SEWER OUTFALL	TWICE COMB. SEWER OUTFALL	ONCE TRIB	TWICE TRIB	ONCE DITCH	TWICE DITCH	TOTAL	INTENSIVE STORM SEWER OUTFALL	INTENSIVE COMBINED SEWER OUTFALL	INTENSIVE TRIB	INTENSIVE DITCH	TOTAL
EA	2	3							5	2				2
ED	2	2							4	2				2
EE														0
EF	3	5				1			9	1		1		2
EG	10	23		1					34	9	1	1		11
EH	4	10							14	5				5
EI		1				1			2					0
EJ		1							1					0
EK	1	6							7	3				3
EL		1							1					0
TOTAL	22	52		1		2			77	22	1	2		25
MA	11	7			1				19					0
MB		2							2					0
MD	9	4							13	3				3
ME	5	12			3				20	2				2
TOTAL	25	25			4				54	5				5
NB	8	5				1			14	3				3
NC	2	16				1			19	5				5
ND	5	12				1			18	7				7
NE	3								3					0
NF	11				1				12	7				7
NG	2	11			8				21	1		1		2
NH	4	5			1				10	3				3
NI	9				1				10	3				3
NJ	4	4			2	1			11	3				3
NK	5	6			1	1			13	5				5
NM	1	8			2	2			13	2				2
NN	6	9			1	2			18	4				4

TABLE V-2 (CONT-D). SUMMARY OF OUTFALL SAMPLING BY REACH

REACH	ONCE STORM SEWER OUTFALL	TWICE STORM SEWER OUTFALL	ONCE COMB. SEWER OUTFALL	TWICE COMB. SEWER OUTFALL	ONCE TRIB	TWICE TRIB	ONCE DITCH	TWICE DITCH	TOTAL	INTENSIVE STORM SEWER OUTFALL	INTENSIVE COMBINED SEWER OUTFALL	INTENSIVE TRIB	INTENSIVE DITCH	TOTAL
NO	1	7			1				9	0				0
NP	8				1				9	2				2
NQ	5	5				1			11	2				2
NR	4	9				1			14	6		1		7
NS	2	6				1			9					0
NT	3	6							9	3				3
NU	7	6							13	5				5
NV		3				2			5	2				2
NW	2	3							5					0
NX	9								9	4				4
NY	3	2			1				6	3				3
TOTAL	104	123			20	14			261	70		2		72
RA	1	1							2	0				0
RB		1				2			3	1				1
RC	4	3			1				8	2				2
RD	1	4							5	2				2
RE	2	1				1	1		5			1		1
RF		6							6	3				3
RG	1	5			1	2			9	3				3
RH						1			1			1		1
TOTAL	9	21			2	6	1		39	11		2		13
SA	6	7	1	4					18	2	1			3
SB	8	11					1		20	10				10
SC	5	17						1	23	13			1	14
SD	1	7							8	6				6
SE	3	5							8	4				4
TOTAL	23	47	1	4			1	1	77	35	1		1	37

TABLE V-2 (CONT-D). SUMMARY OF OUTFALL SAMPLING BY REACH

REACH	ONCE STORM SEWER OUTFALL	TWICE STORM SEWER OUTFALL	ONCE COMB. SEWER OUTFALL	TWICE COMB. SEWER OUTFALL	ONCE TRIB	TWICE TRIB	ONCE DITCH	TWICE DITCH	TOTAL	INTENSIVE STORM SEWER OUTFALL	INTENSIVE COMBINED SEWER OUTFALL	INTENSIVE TRIB	INTENSIVE DITCH	TOTAL
TA				1					1		1			1
TB	1	4	1	4					10	4	2			6
TC	1	1		7					9	1	3			4
TD							1	1	2	0				0
TE	1								1	0				0
TF	6	7							13	2				2
TG	5	1							6	0				0
TH	2								2	0				0
TI		1							1	0				0
TOTAL	16	14	1	12			1	1	45	7	6			13
VA	2	5				1			8	1				1
VB					1				1	0				0
VD	3	4					1		8	1				1
VE									0	0				0
VF		1							1	0				0
VG		3							3	1				1
VH	2	4				1			7					0
VJ	2				1	1			4			1		1
VK		2							2	0				0
VM	1	2				2		1	6					0
VP	1								1					0
TOTAL	11	21			2	5	1	1	41	3		1		4

TABLE V-3. SUMMARY OF AVERAGE OUTFALL DISCHARGE BY REACH

SECOND LETTER	EAST YORK	MARKHAM	NORTH YORK	RICHMOND HILL	SCARBOROUGH	TORONTO	VAUGHAN
A	7.8	35.9		0.8	13.8	0.3	45.7
B		0.8	16.3	2.0	21.4	23.0	0.1
C			31.0	56.8	45.3	35.9	
D	3.2	7.9	12.1	7.9	17.3	0.2	14.5
E	0	24.8	4.2	85.4	4.3	0.0	
F	5.4		4.1	7.0		30.1	5.0
G	31.9		20.5	27.9		9.4	26.0
H	30.1		6.1	1.0		26.2	84.1
I	0.6		20.6			11.8	
J	3.0		6.6				55.9
K	409.1		26.7				60.3
L	0.1						
M			7.4				16.3
N			17.4				
O			4.4				
P			14.9				0.7
Q			9.9				
R			41.4				
S			3.3				
T			7.1				
U			10.5				
V			35.0				
W			2.8				
X			31.8				
Y			20.0				
TOTAL	491.2	69.4	354.1	188.8	102.1	136.9	308.6

APPENDIX VI

SUMMARY OF GROUP A AND GROUP B OUTFALLS

1) Summary of Group A Outfalls for Fecal Coliform Violations Ranked by Loadings

2) Summary of Group A Outfalls for All Other Parameter Violations Ranked by the Number of Modified Bylaw Violations and Average Loadings

3) Summary of Group B Outfalls for Fecal Coliform Violations Ranked by Average Loadings

4) Summary of Group B Outfalls for All Other Parameter Violations Ranked by Number of Modified Bylaw Violations and Average Loadings

GROUP A OUTFALLS

PRIORITY OUTFALLS FOR FECAL COLIFORM VIOLATIONS RANKED BY LOADING

MUNICIPALITY	REACH	OUTFALL	FECAL COLIFORMS	
			COUNTS/SECONDS	COUNTS/100 ML
EAST YORK	EA	208	383706	10161
		207	13677	5098
	ED	241	64780	2347
		245	55737	506700
	EF	1904	1179970	53600
		254	41270	506700
	EG	1907	5539000	52702
		270	4086968	968476
		291	1026380	101924
		275	604693	160396
		286	195754	70516
	EH	162	12550315	148676
		176	2678468	71703
		182	1635450	61206
	EK	222	629335	7973
MARKHAM	MD	820	5300800	132719
		831	343240	16344
		814	31300	15048
NORTH YORK	NB	1418	2246692	34400
		1415	1437850	75549
		1416	318005	225216
	NC	1443	2485016	88687
		1455	664200	9000
		1453	608333	15567
		1463	180591	17158
	ND	503	3168400	313702
		1480	1205611	65671
		501	42741	2599
		504	11548	5201
	NF	524	1417440	226428
		514	1060200	41938
		518	93400	66619
	NI	808	428040	53040
	NJ	1618	112250	120915
		1613	39598	29332
		1614	26476	27295

GROUP A OUTFALLS (Cont'd.)

PRIORITY OUTFALLS FOR FECAL COLIFORM VIOLATIONS RANKED BY LOADING

MUNICIPALITY	REACH	OUTFALL	FECAL COLIFORMS	
			COUNTS/SECONDS	COUNTS/100 ML
NORTH YORK (Cont'd.)	NK	1643	2174256	15685
		1644	678327	7189
		1641	244853	90518
		1626	58609	22033
		1636	20830	13659
	NM	1505	216845	12199
	NN	1544	606576	52922
		1545	314390	25699
	NP	1101	446752	25008
		1115	134371	7472
	NQ	1151	25101	20773
	NR	1254	3696896	87214
		1257	126579	6759
	NT	1171	351718	96981
		1173	140408	37144
	NV	531	496200	427758
		673	100780	27047
	NX	1407	1182840	87140
	NY	702	3096596	18302
		563	582046	27826
RICHMOND HILL	RB	882	117330	49716
	RC	1040	191600	106444
		892	108600	28207
	RD	613	103693	5017
	RF	642	4121298	99869
		638	199400	18930
SCARBOROUGH	SA	339	88337	6695
	SB	378	3694352	909092
		373	1858889	36558
		366	1858691	366004
		349	1589768	181411
		348	694176	117338
		365	247274	18648
		387	184814	28194
		390	59806	6836

GROUP A OUTFALLS

PRIORITY OUTFALLS FOR FECAL COLIFORM VIOLATIONS RANKED BY LOADING

MUNICIPALITY	REACH	OUTFALL	FECAL COLIFORMS	
			COUNTS/SECONDS	COUNTS/100 ML
SCARBOROUGH (Cont'd.)	SC	489	11420641	104819
		1800	1816258	52103
		469	1109066	71654
		404	561813	142171
		472	475250	1329370
		421	154365	3679
	SD	438	48068333	49725862
		439	31634459	769882
		435	349254	20514
		427	325787	37438
		425	135028	2706
		426	20147	13910
	SE	444	5189890	199918
		449	182217	31943
TORONTO	TA	1	88733	31317
	TB	27	45472916	2792604
		28	360345	7410
		35	27343	6696
	TC	47	118695800	1684584
		40	18170833	137259
		43	220565	16460
	TF	66	5478326	33823
VAUGHAN	VA	1197	5480988	47836
	VG	1232	6977173	61867

GROUP A OUTFALLS
PRIORITY OUTFALLS OTHER THAN FECAL COLIFORMS
RANKED BY VIOLATION AND LOADING
(CONT'D)

MUNICIPALITY	VIOLATIONS	OUTFALL NUMBER/REACH	LOAD AVERAGE (gm/day)
		BOD	
Markham	2	MD 820	9.16×10^3
North York	6	NC 1443	7.82×10^3
		NV 1570	1.08×10^3
	5	NH 556	383
	3	NX 1401	1.86×10^4
	2	NR 1164	5.63×10^3
		NC 1439	5.39×10^3
		NN 1544	1.99×10^3
		NR 1256	1.65×10^3
		NC 1463	1.22×10^3
		ND 503	1.16×10^3
		NN 1523	132
		NG 539	109
		NH 550	43
		NU 528	26
	1	NR 1162	1.31×10^5
		NX 1410	1.05×10^4
		NU 534	4.97×10^3
		NC 1438	2.06×10^3
		ND 1480	3.01×10^3
		NP 1101	531
		NC 1453	484
		NR 1163	189
		ND 1472	62
		NY 701	29
		NF 515	6
Richmond Hill	2	RD 612	389
	1	RE 618	881
Scarborough	5	SC 421	2.51×10^4
		SC 472	1.91×10^4
	3	SC 1800	1.82×10^4
		SA 337	4.25×10^3
		SB 349	1.27×10^3
		SC 404	1.17×10^3
		SC 485	824

GROUP A OUTFALLS
PRIORITY OUTFALLS OTHER THAN FECAL COLIFORMS
RANKED BY VIOLATION AND LOADING
(CONT'D)

MUNICIPALITY	VIOLATIONS	OUTFALL NUMBER/REACH	LOAD AVERAGE (gm/day)
		BOD (cont'd)	
Scarborough (cont'd)	2	SB 366	692
		SD 438	543
		SB 351	170
		SE 448	99
		SC 1804	12
	1	SC 489	6.84×10^3
		SD 439	6.49×10^3
		SC 415	854
		SE 444	612
		SB 348	607
		SC 497	54
Toronto	6	TB 27	6.50×10^4
	5	TB 20	7.21×10^4
		TB 36	1.69×10^3
	2	TB 28	5.00×10^4
		TA 1	1.05×10^3
	1	TC 51	7.52×10^3
		TC 47	6.86×10^3
		TC 43	2.13×10^3
		TB 19	1.19×10^3
		SUSPENDED SOLIDS	
East York	4	EH 162	2.61×10^4
		EG 270	564
	3	EG 261	623
		EA 207	525
Markham	2	MD 820	5.33×10^3
North York	6	NC 1439	1.11×10^4
		NC 1438	7.58×10^3
	5	NN 1544	2.98×10^5
		NG 681	1.55×10^4
		NR 1163	1.33×10^4
		NV 1570	350
		NH 556	318
	4	NR 1164	6.98×10^3

GROUP A OUTFALLS
PRIORITY OUTFALLS OTHER THAN FECAL COLIFORMS
RANKED BY VIOLATION AND LOADING
(CONT'D)

MUNICIPALITY	VIOLATIONS	OUTFALL NUMBER/REACH	LOAD AVERAGE (gm/day)
SUSPENDED SOLIDS (cont'd)			
North York (cont'd)	3	NX 1401	4.40×10^4
		NV 1564	1.32×10^4
		NF 515	63
	2	NR 1255	7.03×10^4
		NR 1256	1.12×10^4
		NC 1443	1.36×10^4
		ND 1467	4.74×10^3
		NY 563	4.29×10^3
		NG 539	204
		NH 550	28
		NU 528	28
	1	NR 1162	6.91×10^4
		NX 1410	6.54×10^3
		NM 1502	6.40×10^3
		ND 1480	8.11×10^3
		NU 534	6.12×10^3
		ND 503	2.75×10^3
		NN 1545	2.08×10^3
		NN 1523	129
		ND 1472	85
		NY 701	18
Richmond Hill	6	RH 899	2.03×10^5
	5	RE 618	4.31×10^3
	3	RG 944	1.78×10^6
	2	RF 639	3.72×10^4
		RD 612	23
Scarborough	5	SA 337	2.31×10^4
		SC 485	6.66×10^3
		SC 472	4.21×10^3
		SB 349	1.98×10^3
	4	SC 404	6.44×10^3
		SC 1804	14

GROUP A OUTFALLS
PRIORITY OUTFALLS OTHER THAN FECAL COLIFORMS
RANKED BY VIOLATION AND LOADING
(CONT'D)

MUNICIPALITY	VIOLATIONS	OUTFALL NUMBER/REACH	LOAD AVERAGE (gm/day)
SUSPENDED SOLIDS (cont'd)			
Scarborough (cont'd)	3	SC 421	2.33×10^4
		SC 1800	1.35×10^4
		SC 415	4.00×10^3
		SD 438	534
	2	SD 439	9.14×10^3
		SC 484	1.91×10^3
		SB 348	1.09×10^3
		SB 366	537
		SE 448	76
	1	SC 489	2.43×10^4
		SE 444	452
		SB 351	190
		SC 497	81
Toronto	6	TB 27	2.34×10^5
		TA 1	2.41×10^3
	5	TB 20	5.18×10^4
		TB 36	1.02×10^3
	4	TB 19	1.70×10^4
	2	TC 51	1.34×10^4
		TB 28	1.18×10^4
		TC 47	1.18×10^4
Vaughan	1	VD 1208	9.27×10^4
TOTAL PHOSPHORUS			
East York	5	EG 270	750
	2	EA 207	220
	1	EH 162	873
		EK 222	45
Markham	1	MD 820	498
North York	6	NC 1439	944
		NC 1438	765
	3	NR 1164	2.50×10^5
		NH 556	26
		NG 539	8
		NY 701	5
		NU 528	4

GROUP A OUTFALLS
PRIORITY OUTFALLS OTHER THAN FECAL COLIFORMS
RANKED BY VIOLATION AND LOADING
(CONT'D)

MUNICIPALITY	VIOLATIONS	OUTFALL NUMBER/REACH	LOAD AVERAGE (gm/day)
TOTAL PHOSPHORUS (cont'd)			
North York (cont'd)	2	NR 1256	791
		NN 1544	500
		NR 1163	62
		NT 1173	29
		NN 1523	14
	1	NR 1255	846
		NR 1162	216
		NP 1115	216
		ND 1480	88
		ND 503	80
		NX 1401	40
		NI 981	9
		NU 531	5
		ND 1472	4
		NH 550	2
Richmond Hill	6	RH 899	205
	1	RG 944	1.87×10^3
		RF 639	50
Scarborough	5	SC 472	351
	4	SC 485	178
	3	SC 421	3.57×10^3
		SB 349	91
		SC 404	59
		SD 438	24
		SB 351	20
	2	SE 449	30
	1	SC 489	223
		SD 439	166
		SC 1800	135
		SB 366	41
		SA 330	27
		SC 484	12
		SE 448	8
		SC 497	5

GROUP A OUTFALLS
PRIORITY OUTFALLS OTHER THAN FECAL COLIFORMS
RANKED BY VIOLATION AND LOADING
(CONT'D)

MUNICIPALITY	VIOLATIONS	OUTFALL NUMBER/REACH	LOAD AVERAGE (gm/day)
TOTAL PHOSPHORUS (cont'd)			
Toronto	6	TB 27	1.75×10^3
	4	TB 36	41
	3	TC 51	1.38×10^3
	1	TB 28	663
		TB 19	64
		TA 1	16
Vaughan	1	VD 1208	180
TKN			
East York	1	EG 261	161
North York	1	NR 1162	5.40×10^3
		NR 1163	65
		NF 523	24
		NU 528	14
Scarborough	3	SC 472	405
	1	SD 439	575
		SC 485	101
		SB 351	88
Toronto	6	TB 27	5.45×10^3
	4	TB 36	189
ZINC			
Markham	2	ME 853	8
North York	2	NR 1256	33
	1	NC 1438	336
		NR 1162	108
		NC 1439	107
		ND 1479	13

GROUP A OUTFALLS
PRIORITY OUTFALLS OTHER THAN FECAL COLIFORMS
RANKED BY VIOLATION AND LOADING
(CONT'D)

MUNICIPALITY	VIOLATIONS	OUTFALL NUMBER/REACH	LOAD AVERAGE (gm/day)
		ZINC (cont'd)	
Richmond Hill	1	RG 915	3
Scarborough	4	SB 368 SC 472	704 5
	2	SC 485	30
	1	SC 497	<1
Toronto	1	TB 19	55
		LEAD	
Markham	1	ME 845	2
North York	2	NR 1256	46
	1	NC 1438 NC 1439 NR 1162	502 126 69
Scarborough	2	SC 472	4
	1	SC 404	41
Toronto	1	TB 19	45
		COPPER	
Markham	1	ME 853	1
North York	1	NQ 1150	11
Scarborough	1	SC 404 SC 485	102 4
Toronto	1	TB 19	20

GROUP A OUTFALLS
PRIORITY OUTFALLS OTHER THAN FECAL COLIFORMS
RANKED BY VIOLATION AND LOADING
(CONT'D)

MUNICIPALITY	VIOLATIONS	OUTFALL NUMBER/REACH	LOAD AVERAGE (gm/day)
CHROMIUM			
East York	1	EG 284	16
Markham	2	ME 853	21
North York	4	ND 1479	192
	1	NF 513	23
		NX 1403	3
Scarborough	1	SC 485	15
		SC 497	<1
Toronto	2	TC 40	1.05×10^3
IRON			
East York	5	EG 283	62
	4	EH 162	1.06×10^3
	3	EA 208	599
	1	EK 222	111
North York	5	NN 1544	9.76×10^3
	4	ND 501	791
		NN 1545	79
	3	NC 1438	6.38×10^3
		NR 1255	1.84×10^3
	2	NC 1439	1.42×10^3
		NR 1256	432
		NG 681	191
	1	NR 1162	1.73×10^3
		NB 1418	427
		ND 1467	179
		ND 503	32
		NG 539	7
Richmond Hill	5	RG 899	1.23×10^3
	1	RF 639	1.61×10^3
Scarborough	5	SC 404	388
		SC 475	73

GROUP A OUTFALLS
PRIORITY OUTFALLS OTHER THAN FECAL COLIFORMS
RANKED BY VIOLATION AND LOADING
(CONT'D)

MUNICIPALITY	VIOLATIONS	OUTFALL NUMBER/REACH	LOAD AVERAGE (gm/day)
		IRON (cont'd)	
Scarborough (cont'd)	4	SC 415	5.79×10^3
		SC 399	1.87×10^3
		SC 472	43
	3	SC 485	575
	1	SC 489	203
		SC 1800	168
		SC 497	3
Toronto	5	TB 19	1.26×10^3
Vaughan	1	VA 1197	197
		PHENOLS	
East York	2	EH 162	310
	1	EH 176	18
North York	2	NC 1438	63
		NC 1439	28
	1	NR 1162	9
Richmond Hill	1	RD 612	<1
Toronto	4	TB 27	25
		AVERAGE pH	
Richmond Hill	3	RE 618	12.1
Scarborough	1	SC 421	7.7
	1	SC 484	9.8

GROUP B OUTFALLS

PRIORITY OUTFALLS FOR FECAL COLIFORM VIOLATIONS* RANKED BY LOADING

MUNICIPALITY	REACH	OUTFALL	FECAL COLIFORMS	
			COUNTS/SECONDS	COUNTS/100 ML
East York	EG	297	63000	2100
		261	59049	33936
		1920	20000	500
		287	12200	1000
	EH	175	38000	2000
		166	32190	5191
	EK	233	10500	300
MARKHAM	MA	586	115200	480
		570	82675	3540
		585	14805	2100
		711	16010	1100
	MD	818	21000	21000
	ME	977	153010	1670
		850	29580	870
NORTH YORK	NC	1439	154100	6700
		1465	55110	3300
		1460	10633	9800
	ND	1494	96700	3365
		1469	32227	3512
		1493	12260	2919
	NG	543	71520	1986
		546	44703	2525
		545	22204	801
	NH	551	2200000	2000000
	NI	806	1540000	220000
	NJ	1604	34070	776
	NK	1623	11790	1696
		1622	11020	1900
	NM	1502	10269	354
	NN	1293	23000000	23000000
		1512	128520	1367
		1516	23181	1731
	NO	1549	64282	2621
	NP	1240	121268	1220
		1109	24500	4900

*Represents <4 Samples Averaged

GROUP B OUTFALLS (Cond't.)

PRIORITY OUTFALLS FOR FECAL COLIFORM VIOLATIONS RANKED BY LOADING

MUNICIPALITY	REACH	OUTFALL	FECAL COLIFORMS	
			COUNTS/SECONDS	COUNTS/100 ML
NORTH YORK (Cont'd.)	NQ	1147	33970	790
	NR	1249	935000	5500
		1255	801673	8587
		1164	275530	7069
		1256	198570	132380
		1156	27800	6759
	NT	1170	14606	1340
	NU	534	118400	3200
	NV	1495	480000	1600
		1566	13110	2300
	NW	1132	42720	2400
	NX	1405	251370	2100
		1410	170000	1700
		1404	132000	1200
RICHMOND HILL	RC	890	521680	3501
		910	44800	28207
	RD	599	214650	4167
	RG	944	482980	1718
SCARBOROUGH	SA	338	150926	2703
		337	69487	4594
		335	14315	814
	SB	375	5712000	2800000
		393	79500	37857
		346	41500	6836
	SC	470	407400	21000
		478	244252	3914
		477	144752	1525
		396	78300	54000
		406	61782	4200
	SD	429	45845000	4254756
	SE	451	61820	11000

GROUP B OUTFALLS (Cont'd.)

PRIORITY OUTFALLS FOR FECAL COLIFORM VIOLATIONS RANKED BY LOADING

MUNICIPALITY	REACH	OUTFALL	FECAL COLIFORMS	
			COUNTS/SECONDS	COUNTS/100 ML
TORONTO	TB	34	32540	1221
		19	16680	1268
	TC	51	305858	3267
		53	189840	5600
		49	19938	3157
		50	11850	3950
	TF	59	31464	9988
		64	20321	655
	TG	71	25740	424
	TH	131	698634	16705
		132	197200	2900
VAUGHAN	VA	1202	451810	4992
		1192	130200	6000
		1203	46794	336
	VD	1214	114450	3740
	VG	1233	41690	284
	VH	858	2043500	6700
		863	18270	2100
	VM	1303	379530	2536

GROUP B OUTFALLS
PRIORITY OUTFALLS OTHER THAN FECAL COLIFORMS
RANKED BY VIOLATION AND LOADING
(CONT'D)

MUNICIPALITY	VIOLATIONS	OUTFALL REACH/NUMBER	LOAD AVERAGE (gm/day)
		BOD	
East York	3	EH 162	8.64×10^4
	2	EG 278	108
	1	EH 176	8.30×10^3
		EH 182	909
		EG 270	506
		EA 207	418
		EG 261	347
		EG 278	108
North York	1	NN 1293	1.23×10^3
		NH 551	711
Scarborough	2	SD 429	3.06×10^3
	1	SB 368	1.07×10^4
		SC 406	8.26×10^3
		SUSPENDED SOLIDS	
East York	2	EH 176	9.12×10^3
		EG 281	930
		EH 171	192
		EG 278	75
		EH 158	47
	1	EA 208	2.62×10^4
		EA 210	2.28×10^4
		EH 166	893
		EA 212	812
		EG 283	349
		EK 237	204
		EI 196	131
		EF 259	118
		EG 282	103
		EG 278	75

GROUP B OUTFALLS
PRIORITY OUTFALLS OTHER THAN FECAL COLIFORMS
RANKED BY VIOLATION AND LOADING
(CONT'D)

MUNICIPALITY	VIOLATIONS	OUTFALL REACH/NUMBER	LOAD AVERAGE (gm/day)
SUSPENDED SOLIDS (cont'd)			
North York	2	NW 1129	3.12×10^3
		NF 513	934
		NU 530	130
		NC 1464	59
	1	NH 552	1.26×10^4
		NG 680	8.31×10^3
		NN 1512	8.29×10^3
		NR 1254	7.75×10^3
		NG 679	6.36×10^3
		NQ 1147	5.34×10^3
		NB 1590	5.25×10^3
		NE 512	5.08×10^3
		NG 666	3.11×10^3
		ND 501	2.43×10^3
		NB 1422	2.11×10^3
		NG 661	1.87×10^3
		NN 1511	1.74×10^3
		NR 1156	1.09×10^3
		NH 687	1.07×10^3
		NH 551	862
Toronto	2	TB 22	1.67×10^4
	1	TH 131	6.54×10^5
		TI 69	1.48×10^4
		TH 132	1.29×10^4
		TC 49	1.14×10^3
		TB 79	907
		TF 83	617
		TB 31	320
		TF 88	225
		TC 93	150
		TF 80	122
Vaughan	1	VH 858	8.02×10^4
		VM 1311	2.79×10^4
		VG 1233	1.43×10^4
		VA 1190	1.21×10^4
		VF 1236	6.96×10^3
		VM 1314	2.31×10^3
		VH 863	743
		VH 869	147
		VM 1302	24

GROUP B OUTFALLS
PRIORITY OUTFALLS OTHER THAN FECAL COLIFORMS
RANKED BY VIOLATION AND LOADING
(CONT'D)

MUNICIPALITY	VIOLATIONS	OUTFALL REACH/NUMBER	LOAD AVERAGE (gm/day)
TOTAL PHOSPHORUS			
East York	2	EG 278	12
		EH 166	84
		EG 283	14
Markham	1	MA 570	198
		MD 818	9
		ME 853	8
		MD 825	<1
North York	1	NX 1405	1.22×10^3
		NK 1638	167
		NN 1293	104
		NN 1516	84
		NN 1533	64
		NF 513	26
		NH 551	18
		NC 1460	17
		NR 1156	10
Scarborough	2	SD 429	233
	1	SC 470	1.07×10^4
Toronto	1	TH 131	1.86×10^3
		TC 49	59
		TF 83	16
Vaughan	1	VD 1214	243
IRON			
East York	2	EG 261	69
		EG 269	59
		EH 171	35
		EH 158	35
		EL 188	21
		EK 232	2

GROUP B OUTFALLS
PRIORITY OUTFALLS OTHER THAN FECAL COLIFORMS
RANKED BY VIOLATION AND LOADING
(CONT'D)

MUNICIPALITY	VIOLATIONS	OUTFALL REACH/NUMBER	LOAD AVERAGE (gm/day)
		IRON (cont'd)	
	1	EA 210	1.15×10^3
		EG 290	97
		EH 166	63
		EH 164	60
		EH 1921	29
		EA 205	28
		EF 259	16
		EG 1917	2
Markham	2	ME 946	72
		MA 567	41
	1	MA 574	73
		MA 584	57
		MA 583	40
		MA 568	<1
		MD 825	<1
North York	2	NX 1401	2.43×10^3
		NC 1459	197
		NN 1533	167
		ND 1468	116
		NQ 1141	84
		NG 653	58
		NC 1464	26
		NT 1172	22
		NN 1509	23
		NM 1506	2
	1	NB 1590	627
		NG 680	432
		NM 1502	363
		NE 512	259
		NG 679	258
		NG 666	194
		NY 563	148
		NQ 1145	134

GROUP B OUTFALLS
PRIORITY OUTFALLS OTHER THAN FECAL COLIFORMS
RANKED BY VIOLATION AND LOADING
(CONT'D)

MUNICIPALITY	VIOLATIONS	OUTFALL REACH/NUMBER	LOAD AVERAGE (gm/day)
		IRON (cont'd)	
North York (cont'd)	1	NG 546	129
		NR 1165	121
		NI 803	114
		NQ 1142	79
		NR 1163	64
		NH 686	54
		NM 1504	52
		NC 1461	52
		NO 1553	49
		NM 1701	37
		NN 1703	32
		NB 1417	24
		NX 1409	23
		NC 1466	22
		NI 983	17
		NF 518	11
		NJ 1612	8
		NB 1426	7
		NU 530	6
		NQ 1151	5
		NT 1166	4
		NH 556	2
		NE 510	2
		NU 669	2
		NN 1528	1
		NF 515	1
		NF 519	1
Richmond Hill	2	RF 641	21
	1	RG 944	1.89×10^5
		RE 636	3.82×10^3
		RC 896	2.63×10^3
		RE 632	2.21×10^3
		RG 939	91
		RF 638	56
		RE 627	50
		RD 613	50
		RF 644	38
		RF 637	17
		RG 927	14
		RE 618	16
		RG 934	<1

GROUP B OUTFALLS
PRIORITY OUTFALLS OTHER THAN FECAL COLIFORMS
RANKED BY VIOLATION AND LOADING
(CONT'D)

MUNICIPALITY	VIOLATIONS	OUTFALL REACH/NUMBER	LOAD AVERAGE (gm/day)
		IRON (cont'd)	
Scarborough	2	SC 464	142
		SB 349	54
		SC 458	43
		SC 1804	4
	1	SD 439	80
		SE 451	61
		SC 396	27
		SA 314	19
		SB 353	10
		SC 403	5
		SD 438	4
Toronto	2	TB 27	1.25×10^3
		TB 22	187
		TA 1	113
		TC 49	82
		TC 50	69
		TF 57	41
	1	TH 131	3.44×10^4
		TB 28	9.63×10^3
		TH 132	846
		TC 93	66
		TF 85	36
		TF 88	35
		TD 78	34
		TF 80	7
		TB 36	<1
Vaughan	2	VM 1302	5
	1	VD 1208	1.68×10^4
		VH 858	2.74×10^3
		VM 1311	125
		VM 1314	48
		VH 870	40

GROUP B OUTFALLS
PRIORITY OUTFALLS OTHER THAN FECAL COLIFORMS
RANKED BY VIOLATION AND LOADING
(CONT'D)

MUNICIPALITY	VIOLATIONS	OUTFALL REACH/NUMBER	LOAD AVERAGE (gm/day)
TKN			
East York	1	EG 261	161
Markham	1	ME 953	115
North York	1	NN 1293 NR 1256	445 234
Scarborough	1	SD 438	16
CHROMIUM			
East York	1	EG 284	76
COPPER			
East York	1	EK 232	<1
North York	1	NR 1254	4.33×10^3
LEAD			
East York	1	EF 250	10
PHENOLS			
East York	3 1	EH 162 EH 176 EG 261	620 37 <1
Markham	1	ME 845 ME 946	<1 <1
North York	1	NC 1438	63
Scarborough	2 1	SC 472 SD 439 SC 485	<1 2 <1

APPENDIX VII

FIELD DATA SHEETS

(separate volume)

APPENDIX VIII

DATA BASE

(separate volume)

APPENDIX IX

OUTFALL PHOTOGRAPHS

(separate volume)

APPENDIX X

METROPOLITAN TORONTO AND YORK BYLAW

THE MUNICIPALITY
OF METROPOLITAN TORONTO

BILL No.

BY-LAW No. 148-83.

To regulate the discharge of sewage and land drainage in the Metropolitan Area

1. In this by-law:

(a) "area municipality" means the municipality or corporation of the Borough of East York, the City of Etobicoke, the City of North York, the City of Scarborough, the City of Toronto or the City of York;

(b) "biochemical oxygen demand" means the quantity of oxygen utilized in the biochemical oxidation of matter in 5 days at 20 degrees Celsius;

(c) "body of water" means a river, stream, brook, creek, watercourse, lake, pond, spring, lagoon, marsh, canal or other flowing or standing water;

(d) "colour of a liquid" means the appearance of a liquid from which the suspended solids have been removed;

(e) "combined sewer" means a sewer intended to function simultaneously as a storm sewer and a sanitary sewer;

(f) "Commissioner" means the Commissioner of Works of The Municipality of Metropolitan Toronto or his duly authorized representative;

(g) "composite sample" means a sample which is composed of a series of grab samples taken at intervals during the sampling period;

(h) "connection" means that part or those parts of any drain or system of drains leading directly to a public sewer;

(i) "grab sample" is an aliquot of the flow being sampled taken at one particular time and place;

(j) "grease, fat or oil" means any matter which is extractable from a sample by trichlorotrifluoroethane or other designated solvent and can be determined as "oil and grease";

(k) "Inspector" means a person authorized by The Municipality of Metropolitan Toronto to carry out observations and inspections and to take samples as prescribed by this by-law;

(l) "matter" includes any solid, liquid or gas;

(m) "Municipality" means The Municipality of Metropolitan Toronto;

(n) "person" includes a corporation;

(o) "pH" means the logarithm to the base 10 of the reciprocal of the concentration of hydrogen ions in moles per litre of solution;

(p) "phenolic compounds" means those hydroxy derivatives of benzene and its condensed nuclei, which can be determined as "phenols";

(q) "sanitary sewer" means a sewer for the collection and transmission of domestic, commercial and industrial sewage or any of them;

(r) "sewage" means any liquid waste containing animal, vegetable, mineral or chemical matter in solution or in suspension, except uncontaminated water;

(s) "sewage works" means any works for the collection, transmission, treatment or disposal of sewage, or any part of such works;

(t) "sewer" means a pipe, conduit, drain, open channel, ditch or watercourse for collection and transmission of sewage or storm water;

(u) "Standard Methods" means a procedure set out in "Standard Methods for the Examination of Water and Wastewater" published jointly by the American Public Health Association, American Water Works Association and Water Pollution Control Federation, current at the date of testing, or a procedure approved by an analyst of the Ontario Ministry of the Environment;

(v) "storm water" means water from rainfall or other natural precipitation, ground water or water from the melting of snow or ice;

(w) "storm sewer" means a sewer for the collection and transmission of uncontaminated water, storm water, drainage from land or from a watercourse or any of them;

(x) "suspended solids" means a solid matter in or on a liquid which matter is removable by filtering and can be determined as "total nonfiltrable residue";

(y) "uncontaminated water" means any water, including water from a public or private water works, to which no matter has been added as a consequence of its use, or to modify its use, by any person;

(z) "watercourse" means a open channel, ditch or depression either natural or artificial, in which a flow of storm water occurs either continuously or intermittently.

2. No person shall discharge or deposit or cause or permit the discharge or deposit into a sanitary sewer, combined sewer, public or private connection to any sanitary sewer or combined sewer, matter of any type or at any temperature or in any quantity which may be or may become harmful to a sewage works, or which may interfere with the proper operation of a sewage works, or which may impair or interfere with any sewage treatment process, or which may be or may become a hazard to persons, animals or property.

3. No person shall discharge or deposit or cause or permit the discharge or deposit into a sanitary sewer, combined sewer, public or private connection to any sanitary sewer or combined sewer any of the following:

(a) Matter of a type or quantity that has or may emit a toxic or poisonous vapour or a chemical odor which may interfere with the proper operation of a sewage works, or sewage containing any one or more of the following: bromine, carbon disulphide, hydrogen sulphide, formaldehyde or pyridine;

(b) Gasoline, benzene, naphtha, fuel oil or other flammable or explosive matter or sewage containing any of these in any quantity;

(c) Sewage having pH less than 6.0 or greater than 10.5;

(d) Sewage of which the biochemical oxygen demand exceeds 500 milligrams per litre;

(e) Sewage containing more than 600 milligrams per litre of suspended solids;

(f) Sewage containing more than 150 milligrams per litre of grease, fat or oil;

(g) Sewage which consists of two or more separate liquid layers;

(h) Atomic wastes and radioactive materials except as may be permitted under the Atomic Energy Control Act (Canada) currently in force and regulations thereunder;

(i) Sewage at a temperature greater than 65 degrees Celsius;

(j) Storm water or uncontaminated water, except that which may be discharged into a combined sewer, unless the discharge into a sanitary sewer is permitted by the area municipality;

(k) Sewage containing any of the following matter in excess of the indicated concentrations:

Matter	Concentration in Milligrams per Litre	Expressed as
Aluminum	50	Al
Arsenic	1.0	As
Barium	5.0	Ba
Cadmium	2.0	Cd
Chloride	1500	Cl
Chromium	5.0	Cr
Copper	5.0	Cu
Cyanide	2.0	CN
Fluoride	10	F
Iron	50	Fe
Lead	5.0	Pb
Mercury	0.1	Hg
Nickel	5.0	Ni
Phenolic compounds	1.0	
Phosphorus	100	P
Sulphate	1500	SO_4
Sulphide	2.0	S
Tin	5.0	Sn
Zinc	5.0	Zn

The presence in sewage of any one of the matters on this list in a concentration in excess to its limit consititutes a separate offence.

4. No person shall discharge or deposit or cause or permit the discharge or deposit into a storm sewer, land drainage works, watercourse, public or private connection to any storm sewer, matter of any type or at any temperature or in any quantity which may interfere with the proper operation

of a storm sewer, or which may obstruct a storm sewer or the flow therein, or which may be or may become a hazard to persons, animals or property, or which may impair the quality of the water in any well, reservoir or other body of water.

5. No person shall discharge or deposit or cause or permit the discharge or deposit into a storm sewer, land drainage works, watercourse, public or private connection to any storm sewer any of the following:

   (a) Any matter that has or may emit an offensive odour which causes or is likely to cause harm or material discomfort to any person or damage to property or to plant and animal life;

   (b) Gasoline, benzene, naphtha, fuel oil or other flammable or explosive matter or sewage containing any of these in any quantity;

   (c) Sewage having a pH less than 6.0 or greater than 9.5;

   (d) Sewage of which the biochemical oxygen demand exceeds 15 milligrams per litre;

   (e) Sewage containing more than 15 milligrams per litre of suspended solids;

   (f) Sewage containing more than 15 milligrams per litre of grease, fat or oil;

   (g) Sewage which consists of two or more separate liquid layers;

   (h) Atomic wastes and radioactive materials except as may be permitted under the Atomic Energy Control Act (Canada) currently in force and regulations thereunder;

   (i) Sewage or uncontaminated water at a temperature greated than 65 degrees Celsius;

   (j) Sewage containing coloured matter, which sewage would require a dilution in excess of 4 parts of distilled water to 1 part of such sewage to produce a mixture the colour of which is not distinguishable from that of distilled water;

   (k) Sewage containing any matter which will not pass through a screen having openings not larger than 3.35 millimetres square (No. 6 standard sieve);

(l) Sewage containing any of the following matter in excess of the indicated concentrations:

Matter	Concentration in Milligrams per Litre	Expressed as
Aluminum	1.0	Al
Ammonia	10.0	N
Arsenic	1.0	As
Barium	1.0	Ba
Cadmium	0.1	Cd
Chlorine	1.0	Cl_2
Chromium	1.0	Cr
Copper	1.0	Cu
Cyanide	0.1	CN
Fluoride	2.0	F
Iron	1.0	Fe
Lead	1.0	Pb
Manganese	1.0	Mn
Mercury	0.001	Hg
Nickel	1.0	Ni
Phenolic compounds	0.02	
Phosphorus	1.0	P
Tin	1.0	Sn
Zinc	1.0	Zn

The presence in sewage of any one of the matters on this list in a concentration in excess of its limit constitutes a separate offence.

6. (a) For the purpose of determining the characteristics of the sewage to which reference is made in this by-law, one sample alone is sufficient and without restricting the generality of the foregoing the sample may be a grab sample or a composite sample, may contain additives for its preservation and may be collected manually or by using an automatic sampling device;

(b) Except as otherwise specifically provided in this by-law, all tests, measurements, analyses and examinations of sewage, its characteristics or contents shall be carried out in accordance with Standard Methods;

(c) For each one of the following metals: aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, tin and zinc, whose concentration in sewage is limited in Sections 3(k) and 5(l), the analysis shall be for the quantity of total metal, which includes all metal both dissolved and particulate.

7. (a) The owner or occupant of commercial, institutional or industrial premises with one or more connections to a public sewer shall install and maintain in good repair in each connection a suitable manhole to allow observation, sampling and measurement of the flow of sewage therein, provided that where installation of a manhole is not possible, an alternative device or facility may be substituted with the approval of the Commissioner;

(b) Every manhole, device or facility installed as required by Section 7(a) of this by-law shall be designed and constructed in accordance with good engineering practice, and shall be constructed and maintained on the lands of the owner or occupant of the premises at his expense;

(c) The owner or occupant of commercial, institutional or industrial premises shall ensure that every manhole, device or facility installed as required by Section 7(a) of this by-law is accessible at all reasonable times for the purposes of observing, sampling and measuring the flow of sewage therein.

8. (a) The discharge or deposit of sewage that would otherwise be prohibited by this by-law may be permitted in the sanitary or combined sewer or a sewage works to an extent fixed by agreement with the Municipality under such conditions with respect to payment or otherwise as may be necessary to compensate for any additional costs of treatment;

(b) A person who has entered into an agreement with the Municipality with respect to the discharge or deposit of sewage shall not be prosecuted under this by-law for the discharge or deposit of sewage in accordance with the terms of that agreement.

9. (a) The owner or occupant of commercial, institutional or industrial premises may submit to the Commissioner a program to prevent or to reduce and control the discharge or deposit of sewage or uncontaminated water from those premises into connections to a sewage works or to a storm sewer;

(b) The Commissioner may issue an approval to be known as a 'program approval' to the person who submitted the program;

(c) A person to whom a program approval has been issued shall not be prosecuted under this by-law for the discharge or deposit of sewage during the period within which the program approval is applicable provided that the person complies fully with the terms of the program approval.

10. No person shall prevent, hinder, obstruct or interfere in any way with the Commissioner or an Inspector, bearing proper credentials and identification, from:

(a) Entering in or upon any land or premises, except land or premises being used as a dwelling house, at any reasonable time;

(b) Making such tests or taking such samples as he deems necessary; or

(c) Inspecting or observing any plant, machinery, equipment, work or activity for the purposes of administering or enforcing this by-law.

11. No person shall break, damage, destroy, deface or tamper with:

(a) Any part of a public sewage works;

(b) Any device whether permanently or temporarily installed in a public sewage works or connection to a public sewer for the purpose of measuring, sampling and testing of sewage, storm water or uncontaminated water.

12. (a) Every person who contravenes any provison of this by-law is guilty of an offence and on conviction is liable to a fine of not more than $2,000 for every day or part thereof upon which such offence occurs or continues;

(b) Any person convicted under this by-law shall forfeit and pay for a breach of any provision of this by-law a minimum penalty of $500 exclusive of costs for the first offence, a minimum penalty of $750 exclusive of costs for the second offence and a minimum penalty of $1,000 exclusive of costs for each subsequent offence;

(c) It is the intention of this by-law that all offences created herein are deemed to be of absolute liability.

13. By-law 2520 "To regulate the discharge of sewage and land drainage in the Metropolitan Area", as amended, is hereby repealed.

ENACTED AND PASSED this 14th day of October, A.D. 1983.

W.J. LOTTO,
Metropolitan Clerk.

PAUL V. GODFREY,
Chairman.

(Corporate Seal)

THE REGIONAL MUNICIPALITY OF YORK

BILL NO. 85

BY-LAW NO. S-23-78-78

To regulate the discharge of sewage and land drainage in the Regional Area

1. In this By-law:
   - (a) "Area Municipality" means the municipality or corporation of the Town of Aurora, the Town of Markham, the Town of Newmarket, the Town of Richmond Hill, the Town of Vaughan, the Town of Whitchurch-Stouffville, the Town of East Gwillimbury, the Township of Georgina and the Township of King;
   - (b) "biochemical oxygen demand" means the quantity of oxygen utilized in the biochemical oxidation of matter in five (5) days at twenty (20) degrees Celsius;
   - (c) "colour of a liquid" means the appearance of a liquid from which the suspended solids have been removed;
   - (d) "combined sewer" means a sewer intended to function simultaneously as a storm sewer and a sanitary sewer;
   - (e) "matter" includes any solid, liquid or gas;
   - (f) "Municipality" means The Regional Municipality of York;
   - (g) "person" includes a corporation;
   - (h) "pH" means the logarithm to the base 10 of the reciprocal of the concentration of hydrogen ions in grams per litre of solution;
   - (i) "phenolic compounds" means those derivatives of aromatic hydrocarbons which have a hydroxyl group directly attached to the ring;

(j) "private branch drain" means piping in or adjacent to a building or other structure that receives sewage discharge from such structure and conveys it to the sewer connection;

(k) "Regional Area" has the same meaning as in The Regional Municipality of York Act, R.S.O. 1970, Chapter 408, as amended;

(l) "sanitary sewer" means a sewer for the collection and transmission of domestic, commercial and industrial sewage or any of them;

(m) "sewage" means any liquid waste containing animal, vegetable or mineral matter in solution or in suspension, except uncontaminated water;

(n) "sewage works" means any works for the collection, transmission, treatment or disposal of sewage, or any part of any such works;

(o) "standard methods" means a procedure set out in "Standard Methods for the Examination of Water and Wastewater", 14th Edition, 1976 published jointly by American Public Health Association, American Water Works Association and Water Pollution Control Federation;

(p) "storm water" means water from rainfall or other natural precipitation, ground water, or from the melting of snow or ice;

(q) "storm sewer" means a sewer for the collection and transmission of uncontaminated water, storm water, drainage from land or from a watercourse or any of them;

(r) "suspended solids" means solid matter in or on a liquid which matter is removable by filtering;

(s) "uncontaminated water" means water to which no matter has been added as a consequence of its use, or to modify its use, by any person;

(t) "watercourse" means an open channel, ditch or depression either natural or artificial, in which a flow of storm water occurs, either continuously or intermittently.

2. No person shall discharge or deposit or cause or permit to be discharged or deposited into a sanitary sewer, a combined sewer, a private branch drain or connection to a sanitary sewer or combined sewer, matter of a kind or at a temperature or in a quantity which is or may become harmful to a sewage works or which interferes with the proper operation of a sewage works or which impairs or interferes with a sewage treatment process or which is or may become hazardous to persons, animals or property.

3. No person shall discharge or deposit or cause or permit to be discharged or deposited into a sanitary sewer, a combined sewer, a private branch drain or connection to a sanitary sewer or combined sewer, any of the following:

(a) sewage that causes or is likely to cause an offensive odour to emanate from a sewage works;

(b) storm water, water from drainage of roofs or land or from a watercourse, or uncontaminated water; except that such may be discharged into a combined sewer;

(c) sewage at a temperature greater than 65 degrees Celsius;

(d) sewage having a pH less than 6.0 or greater than 10.5 or which due to its nature or content becomes less than 6.0 or greater than 10.5 within a sewage works;

(e) explosive matter, gasoline, benzene, naptha, fuel oil or sewage containing any of these;

(f) sewage containing more than 100 milligrams per litre of solvent extractible matter of animal or vegetable origin;

(g) sewage containing more than 15 milligrams per litre of solvent extractible matter of mineral or synthetic origin;

(h) sewage which consists of two or more separate liquid layers;

(i) sewage of which the biochemical oxygen demand exceeds 500 milligrams per litre;

(j) sewage containing more than 600 milligrams per litre of suspended solids;

(k) sewage capable of causing obstruction to the flow in, or excessvie wear and tear, corrosion or any other damage to, or interference with the proper operation of the sewage works and, without limiting the generality of the foregoing, sewage shall not contain ashes, cinders, garbage, straw, shavings, metal, glass, rags, feathers, tar, plastics, wood or cellulose;

(l) sewage containing animal wastes and, without limiting the generality of the foregoing, shall not contain hair, wool, fur, feathers, intestines, stomach casings, pauch manure, hides, intestinal contents, poultry heads, toenails, horns, bones and fleshings;

(m) sewage containing toxic or poisonous substances in such concentration or quantity that the sewage may interfere with or impair any sewage treatment process or be a hazard to persons or animals;

(n) sewage containing matter named and symbolized in Columns 1 and 2 respectively of the following table, in excess of the concentration set out in

Column 3 of the following table opposite the name and symbol of such matter:

Column 1 Matter	Column 2 Symbol	Column 3 Concentrations in Milligrams per Litre
Aluminum	Al	50
Arsenic	As	1.0
Barium	Ba	5.0
Cadmium	Cd	2.0
Chloride	Cl	1500
Chromium	Cr	5.0
Copper	Cu	5.0
Cyanide	HCN	2.0
Fluoride	F	10
Iron	Fe	50
Lead	Pb	5.0
Mercury	Hg	0.1
Nickel	Ni	5.0
Phenolic Compounds		1.0
Phosphorus	P	100
Sulphate	SO_4	1500
Sulphide	S	2.0
Tin	Sn	5.0
Zinc	Zn	5.0

4. No person shall discharge or deposit or cause or permit to be discharged or deposited into a storm sewer, land drainage works, private branch drain or connection to any storm sewer of matter of a type or at a temperature or in a quantity which interferes with the operation of a storm sewer or which obstructs a storm sewer or the flow therein or which is or may become a hazard to persons, animals or property or

which impairs or is likely to impair the quality of water in a well, lake, river, pond, spring, stream reservoir or watercourse.

5. No person shall discharge or deposit or cause or permit to be discharged or deposited into a storm sewer, land drainage works, private branch drain or connection to a storm sewer, any of the following:

(a) uncontaminated water at a temperature greater than 65 degrees Celsius;

(b) sewage at a temperature greater than 65 degrees Celsius;

(c) sewage having a pH less than 6.0 or greater than 9.5 or which due to its nature or content becomes less than 6.0 or greater than 9.5;

(d) explosive matter, gasoline, benzene, naptha, fuel oil or sewage containing any of these in any quantity;

(e) sewage containing more than 15 milligrams per litre of solvent extractible matter;

(f) sewage which consists of two or more separate liquid layers;

(g) sewage containing coloured matter, which sewage would require a dilution in excess of four (4) parts of distilled water to one (1) part of such sewage to produce a mixture the colour of which is not distinguishable from that of distilled water;

(h) sewage of which the biochemical oxygen demand exceeds 15 milligrams per litre;

(i) sewage containing more than 15 milligrams per litre of suspended solids;

(j) sewage containing any matter which will not pass through a screen having openings not larger than 3.35 millimetres square (No. 6 standard sieve);

(k) sewage containing matter named and symbolized in Columns 1 and 2 respectively of the following table, in excess of the concentration set out in Column 3 of the following table opposite the name and symbol of such matter:

STORM SEWER ~~Discharge~~

Column 1 Matter	Column 2 Symbol	Column 3 Concentrations in Milligrams per Litre
Aluminium	Al	1.0
Ammonia	N	10
Arsenic	As	1.0
Barium	Ba	0.1
Cadmium	Cd	0.1
Chlorine	Cl_2	1.0
Chromium	Cr	1.0
Copper	Cu	1.0
Cyanide	HCN	0.1
Fluoride	F	2.0
Iron	Fe	1.0
Lead	Pb	1.0
Manganese	Mn	1.0
Mercury	Hg	0.001
Nickel	Ni	1.0
Phenolic Compounds		0.02
Phosphourus	P	1.0
Suspended Solids		15
Tin	Sn	1.0
Zinc	Zn	1.0
Temp		65 °C
BOD		

6. Except as otherwise specifically provided in this By-law, all tests, measurements, analyses and examinations of

sewage, its characteristics or contents shall be carried out in accordance with standard methods.

7. (1) The owner or occupant of commercial or industrial premises with one or more connections to a sewage works shall install and maintain in good repair in each connection a suitable manhole to allow observation, sampling and measurement of the flow of sewage in such connection provided that where installation of a manhole is not practical, an alternative means of observation, sampling and measurement may be substituted with the approval of the Area Municipality.

(2) Every manhole, or alternative, installed as required by subsection 1 of this section shall be designed and constructed in accordance with good engineering practice and the requirements of the Area Municipality, and shall be constructed and maintained on the lands of the owner or occupant of the premises at his expense.

(3) The owner or occupant of commercial or industrial premises shall at all times ensure that every manhole, or alternative, installed as required by subsection 1 of this section is at all times accessible to a representative of the Municipality for the purposes of observing, sampling and measuring the flow of sewage.

(4) The Municipality may require the owner or occupant of commercial or industrial premises to install devices to sample and analyze sewage discharges from such premises and to submit reports thereon to the Municipality.

8. (1) The discharge of an industrial waste that would otherwise be prohibited by this By-law may be permitted in the sanitary or combined storm and sanitary system to an

extent fixed by agreement in writing with the Municipality and under such terms and conditions, including payments to be made to the Municipality, as may be contained in the agreement.

(2) A person who has entered into an agreement with the Municipality under subsection 1 of this section with respect to the discharge or deposit of sewage shall not be prosecuted under section 2 for the discharge or deposit of sewage in accordance with the terms of the agreement.

9. (1) The owner or occupant of commercial or industrial premises may submit to the Municipality a program to prevent or to reduce and control the discharge or deposit of sewage or uncontaminated water into connections to a sewage works or to a storm sewer from those premises.

(2) The Municipality may issue an approval to be known as a "program approval" to the person who submitted the program.

(3) A person to whom a program approval has been issued shall not be prosecuted under this By-law for the discharge or deposit of sewage during the period within which the program approval is in force provided that the person complies fully with the terms of the program approval.

10. (1) For the purposes of the administration of this By-law, a representative of the Municipality may, upon production of his identification, enter any commercial or industrial premises to observe, measure and sample the flow of sewage to any sewer.

(2) For any sewage works connected to works provided by the Crown under agreement between the Crown and The

Regional Municipality of York dated the 11th day of July, 1975 and any amendments thereto, a representative of The Municipality of Metropolitan Toronto shall be deemed to be a representative of the Municipality for the purposes of subsection 1 of this section.

11. No person shall break, damage, destroy, deface or tamper with:

(a) any part of a sewage works;

(b) any device whether permanently or temporarily installed in a sewage works for the purpose of measuring, sampling and testing of sewage.

12. Every person who contravenes any provision of this By-law is liable on summary conviction to a fine of not more than $1,000.00 for every day or part thereof on which such contravention occurs or continues, such penalty being in addition to any other remedy or penalty provided by law.

READ A FIRST AND SECOND TIME the 22nd day of June A.D. 1978.

READ A THIRD TIME AND ENACTED AND PASSED the 22nd day of June A.D. 1978.

[signature] Clerk

[signature] Chairman